(Change in the ... of photon light).
by the impact

3rd Class
22/1/03.

Quantum numbers.

"A set of numbers which provide complete description of an electron in an atom is called quantum numbers."

There are four quantum numbers.

(1) Principal quantum number.
2. Azimuthal quantum number.
3. Magnetic quantum number.
4. Spin quantum number.

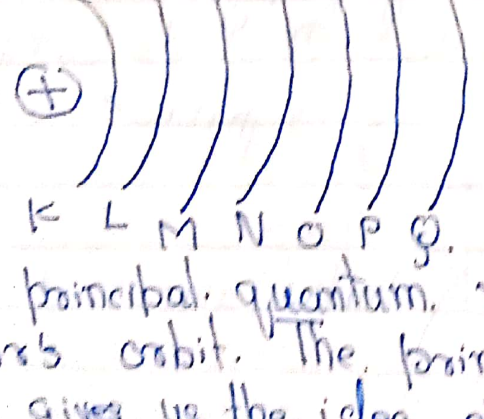
1. Principal quantum number: This gives us the idea of main energy level in which the electron may be found. It is denoted by 'n' where n = 1, 2, 3, 4 . . . . . .

n = 1, K-shell.
n = 2, L-shell.
n = 3, M-shell.
n = 4, N-shell.

$$E_n = -\frac{2\pi^2 m e^4 z^2}{n^2 h^2}$$

$$= \frac{A z^2}{n^2}$$

$$A = 2.18 \times 10^{-18}$$



The principal quantum number is actually the Bohr's orbit. The principal quantum number also gives us the idea of the size of the atom.

2. Azimuthal quantum number: The main energy

level is divided into sub-levels or sub-shells. These are called Azimuthal quantum number. It is also called as subsidiary quantum number or secondary quantum number or orbital momentum quantum momentum quantum number. It is denoted by 'l'. For each value of n l has 0 to (n-1) values.

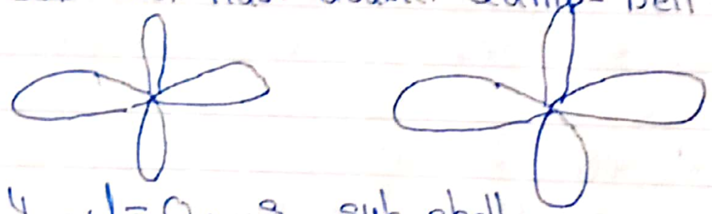
e.g. n=1, l=0 s-sub-shell (spherical shape)

n=2, l=0,1.
l=0 → s sub-shell
l=1 → p-sub-shell

p sub-shell has dump-bell shape.

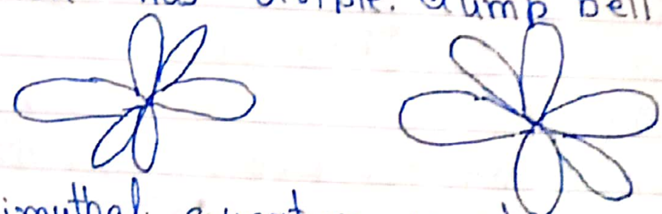
n=3, l=0 s sub- sub-shell.
l=1, p sub- sub-shell. 
l=2. d sub- shell.

d. sub-shell has double dump- bell shape.



n=4, l=0, s sub-shell
l=1, p-sub-shell.
l=2, d-sub-shell.
l=3, f-sub-shell.

f sub-shell. has trible. dump bell shape.



The azimuthal quantum numbers gives us the idea of shape of the space in which the electron may be formed.

3). Magnetic quantum number. We know that when electron flows through a loop, it creates the magnetic field. So.

the electrons moving in an atom creates magnetic field. When a strong magnetic field is applied outside the atom (Zeeman's effect). there is interaction between the two fields. As a result of this the electron moving in a particular sub-shell undergoes reorientation in certain definite regions of space called orbitals.

I. Definition of orbitals: That three dimensional space around the nucleus in which the probability of finding the electron is maximum is called an orbital.

The number of orbitals in a sub-shell present in a shell is given by a third quantum number called magnetic quantum number.

It is denoted by m_l. For each value of l, m_l has $(2l+1)$ values ranging from $-l$ through zero to $+l$.

e.g. $n = 1$, $m_l = 0$, s-orbital.
number of orbital = one.

when $n=1$. the number of orbital = one.

$n = 2$, $l = 0$, $m_l = 0$, s orbital.
$l = 1$ $m_l = -1, 0, +1$.
px py pz.
three p orbitals.

when $n = 2$,
total number of orbitals = 4.

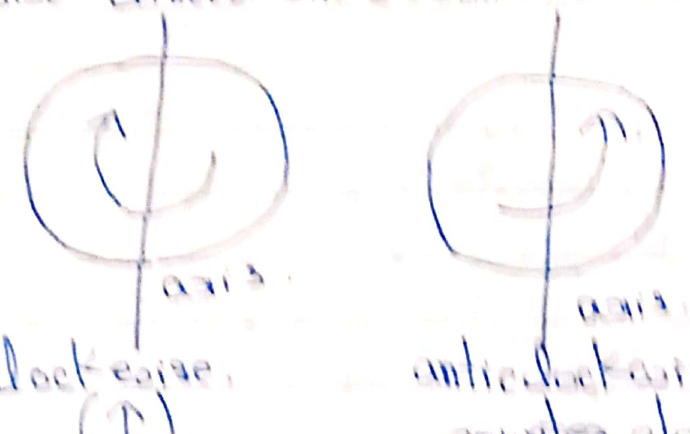
$n = 3$. $l = 0$ $m_l = 0$. s orbital.
$l = 1$. $m_l = -1, 0, +1$. three p-orbitals.
$l = 2$, $m_l = -2, -1, 0, +1, +2$.
five d orbitals.

when $n = 3$, total number of orbital = 9.

$n = 4$, $l = 0$, $m_l = 0$, s orbital.

$l=1$, $m_l = -1, 0, +1$, three p-orbitals.
$l=2$, $m_l = -2, -1, 0, +1, +2$. five d-orbitals
d_{xy} d_{yz} d_{xz} $d_{x^2-y^2}$ d_{z^2}
$l=3$, $m_l = -3, -2, -1, 0, +1, +2, +3$.
= Seven f orbitals.
∴ $n=4$, total number of orbitals = 16.
∴ Number of orbitals present in a shell is given by n^2 where n = principal quantum number.

(4). Spin quantum number.
The electrons have spinning motion also. They may spin in the clockwise or anticlock-wise direction. (counterclockwise direction.



4th Class Spin quantum number 27/11/03
The spinning motion of the electron is also quantised. It is expressed by the.

4th Class. 27/11/03.

Spin quantum number

The spinning motion of the electron is also quantised. It is expressed by the 4th quantum number called spin quantum. It is denoted by m_s. For each value of m_l, m_s has two values $+\frac{1}{2}$ and $-\frac{1}{2}$ or $+\frac{1}{2}$

$m_s = \pm\frac{1}{2}$ ~~(2e)~~ 2 electrons (2e)

$l = 1, \rightarrow m_l = -1, 0, +1$

$m_s = \pm\frac{1}{2}, \pm\frac{1}{2} \pm\frac{1}{2}$ (6e).

∴ When $n = 2$, total numbers of electrons = 8e

$n = 3, \quad l = 0 \quad m_l = 0.$

$m_s = \pm\frac{1}{2}$ (2e).

$l = 1, \quad m_l = -1, 0, +1.$

$m_s = \pm\frac{1}{2}, \pm\frac{1}{2}, \pm\frac{1}{2}$ = (6e).

$l = 2, \quad m_l = -2, -1, 0 +1, +2.$

$m_s = \pm\frac{1}{2}, \pm\frac{1}{2}, \pm\frac{1}{2}, \pm\frac{1}{2}, \pm\frac{1}{2}.$

= (10 e) ∴ When $n = 3$,

Total number of electrons = 18.

When $n = 4, \quad l = 0, \quad m_l = 0.$

$m_s = \pm\frac{1}{2}$ (2e).

$l = 1, \quad m_l = -1, 0, +1$

$m_s = \pm\frac{1}{2}, \pm\frac{1}{2}, \pm\frac{1}{2}$ (6e).

$l = 2, \quad m_l = -2, -1, 0, +1 +2.$

$m_s = \pm\frac{1}{2}, \pm\frac{1}{2}, \pm\frac{1}{2}, \pm\frac{1}{2}, \pm\frac{1}{2}$ = (10 e).

$l = 3, \quad m_l = -3, -2, -1, 0 +1, +2, +3.$

$m_s = \pm\frac{1}{2}, \pm\frac{1}{2}, \pm\frac{1}{2}, \pm\frac{1}{2}, \pm\frac{1}{2},$ ~~(10e)~~ $\pm\frac{1}{2} \pm\frac{1}{2}$

= 14e.

∴ When $n = 4$, total number of electrons = 32.

∴ Total number of electrons in a shell is $2n^2$.

where n = principal quantum number. X