Bohr Model of Atom

- Atom is very small spherical particle composed of protons, neutrons and electrons

- The centre of atom is called nucleus, consist of p and n
- The negatively charged electrons are revolving around nucleus called orbits.Denoted as 1,2,3,4….. Or K,L,M,O.
- The electrostatic force of attraction b/n the nucleus and electron is exactly balanced by the centrifugal force of moving electone.

- Each orbit is associated by definite amount of energy ,so they called stationary states.

- An electron does not absorb or emit energy as long as the electron remain in the same orbit
- The angular momentum of an orbit can be calculated by
  $mvr=nh/2\pi$
- The emission and absorption of energy occur only when the electron jump from one orbit to another
  $\Delta E=E2-E1=hv$

Merits of Bohr model

1. It can give a satisfactory explanation about the structure of atom
2. It helped to calculate the energy of electron and radius of orbit
3. It can explain the emission and absorption spectra of hydrogen atom

Demerits of Bohr model

1. Failed to explain the spectrum of complicated atoms
2. It could not explain the Zeeman effect(Splitting of spectral line in magnetic field),Stark effect(Splitting of spectral line in electric field)\
3. Does not tell about chemical bonding of atom
4. Does not explain Heizenberg’s uncertinitry principle

deBroglie concept

All microscopic particle like electron exhibit wave nature and particle nature during its motion. It is called Dual nature of matter.

$$\lambda = h/mv \text{ or } \lambda = h/p$$

h= plank's constant,m=mass of particle ,v= velocity,p=momentum

λ= wavelength of matter

Heizenberg's uncertinity principle

It is impossible to determine simultaneously the exact position and of momentum Of small moving particle like electron.

$$(\Delta x)\ (\Delta p) \geq h/4\pi$$

Δx= uncertanity in position

Δp= uncertanity in momentum.

ORBITAL

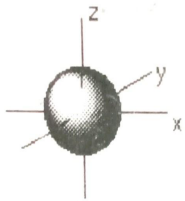
Region in space in an atom where there is maximum probability to finding electrons

https://www.youtube.com/watch?v=Q0UEMXM5MTI

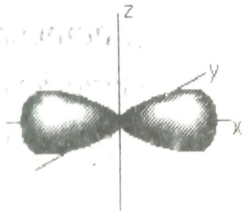
Shapes of orbitals

Shapes of orbitals

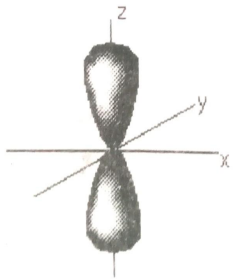
The shape of s and p orbitals



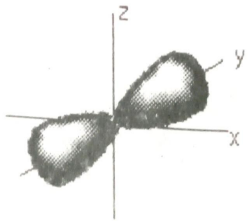
s



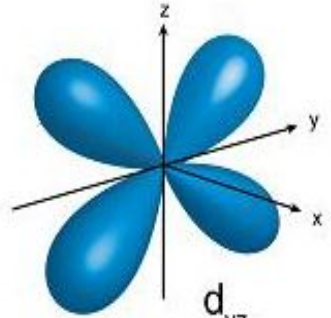
p_x



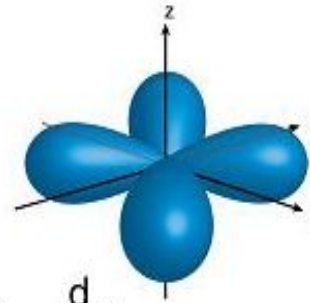
p_z



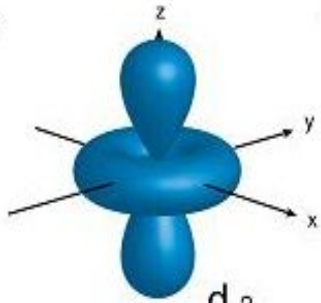
p_y



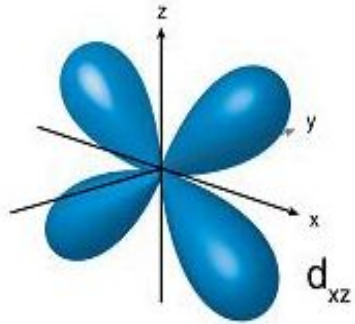
d_{yz}



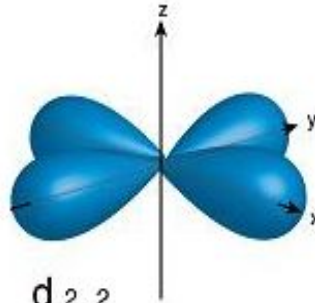
d_{xy}



d_{z^2}



d_{xz}



$d_{x^2-y^2}$

Difference b/n Orbit and Orbital

Orbit

- It is the circular path around the nucleus,where the electron is revolving.
- It represent a planar motion of electron .
- It represent circular shape
- The maximum number of electron in an orbit is $2n^2$

Orbital

- It is the space around the nucleus where there is maximum probability of finding electron
- It represent Three dimensional motion of electron
- It have different shapes like s-spherical,p-domble etc
- The maximum number of electron in each orbital is 2

Quantum Numbers

It is the set of four numbers to designate the main energy level,sub energy level ,the orbital and spin of electron in an atom

- **They are-Principal Q.no,Subsidiary Q.no,Magnetic Q,no and Spin Q.no**

$2P_x^1$

Principal quantum Number(n)

- It represent the main energy level of the atom
- n take the values 1,2,3… or K,L,M,N….
- The maximum number of electron in the orbit is $2n^2$

Value of *n*	1	2	3	4
Name of shell (orbit)	K	L	M	N
Max no.of electrons($2n^2$)	2	8	18	32

Subsidiary Or Azimuthal Quantum Number(l)

- It represent the Sub Energy level of electron in the atom
- It take the values 0 to n-1
- Ex-when n=1,l=0 to (1-1)ie 0,so l=0 that is 1s subshell
- When n=2 then l=0 to(2-1) ie 0 to 1 ie 0,1 values they are 2s and 2p sub shells ……

Value of *l*	0	1	2	3
Name of subshell	s	p	d	f
Max no.of electrons $2(2l+1)$	2	6	10	14

Magnetic Quantum number (m)

- It represent the orbital in a subshell
- There can be 2l+1 integral values between -l to o to +l
- If l=0 ,m=0 ie only one orbital in s subshell
- If l=1 then m= -1,0,+1 : three orbital in p subshells
- If l=2 then m=-2,-1,0,+1,+2: five orbital in d sub shells.

Spin Quantum Number(s)

- It represent the spin of electron in the orbital
- For each value of m there are two values for s that is =+½ and -½
- The electron may be in clockwise or anticlockwise spin in the orbital

Rules for filling electron in the shells of an atom

1. Pauli's exclusion principle
2. Hund's rules of maximum multiplicity
3. Aufbau principle

Pauli's Exclusion Principle

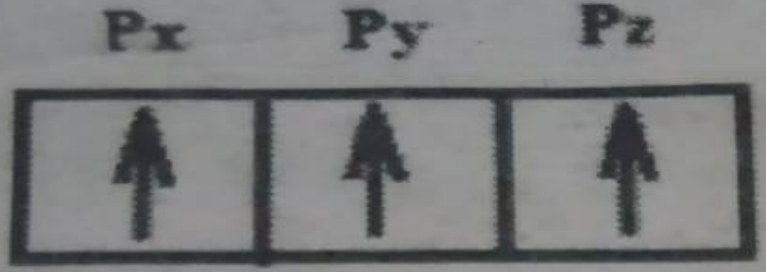
- ★ It is impossible for two electron in an atom to have the same value for the all the four quantum numbers.
- ★ An orbital cannot have more than two electron
- ★ If an orbital have two electron then at least their spin must be opposite signs .

$1s^{+½}$

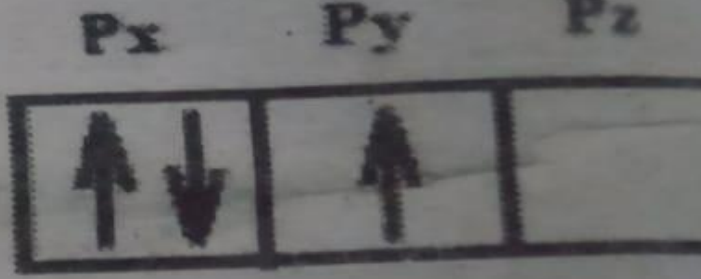
$1s^{-1/2}$

Hund's rules of maximum Multiplicity

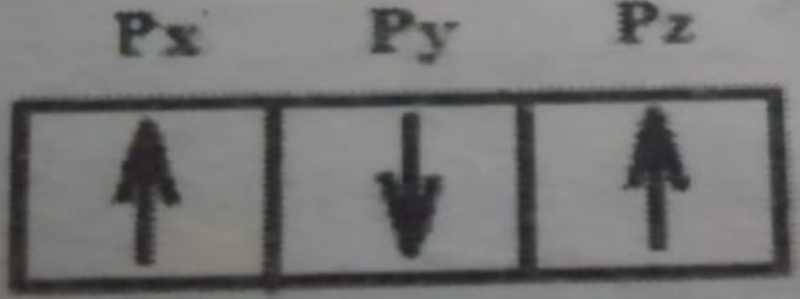
- Pairing of electone does not take place until all the orbitals are singly occupied by the electrons
- All the singly occupied electrons have the same spins



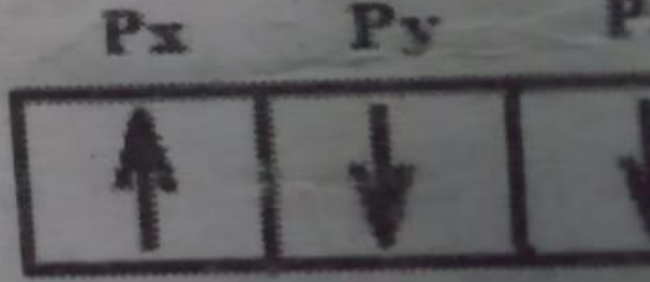
case_1 — Correct



case2 — Wrong



case 3 Wrong



case4 Wrong

Aufbau Principle

- Electrons in an atom are occupied in the orbital in the increasing order of the energy level.

- **1s<2s<2P<3s<3p<4s<3d<4p<5s<4d<5p<6s<4f<5d<6p<7s<5f<6d<7p**