بِسْمِ اللهِ الرَّحْمٰنِ الرَّحِيْمِ

বিস্‌মিল্লাহির রাহ্‌মানির রাহীম

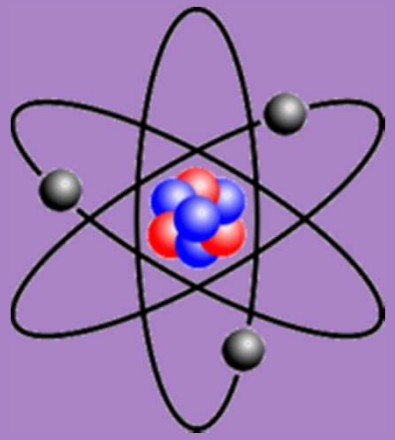
উদ্ভাস

একাডেমিক এন্ড এডমিশন কেয়ার

Class: 9 Chemistry

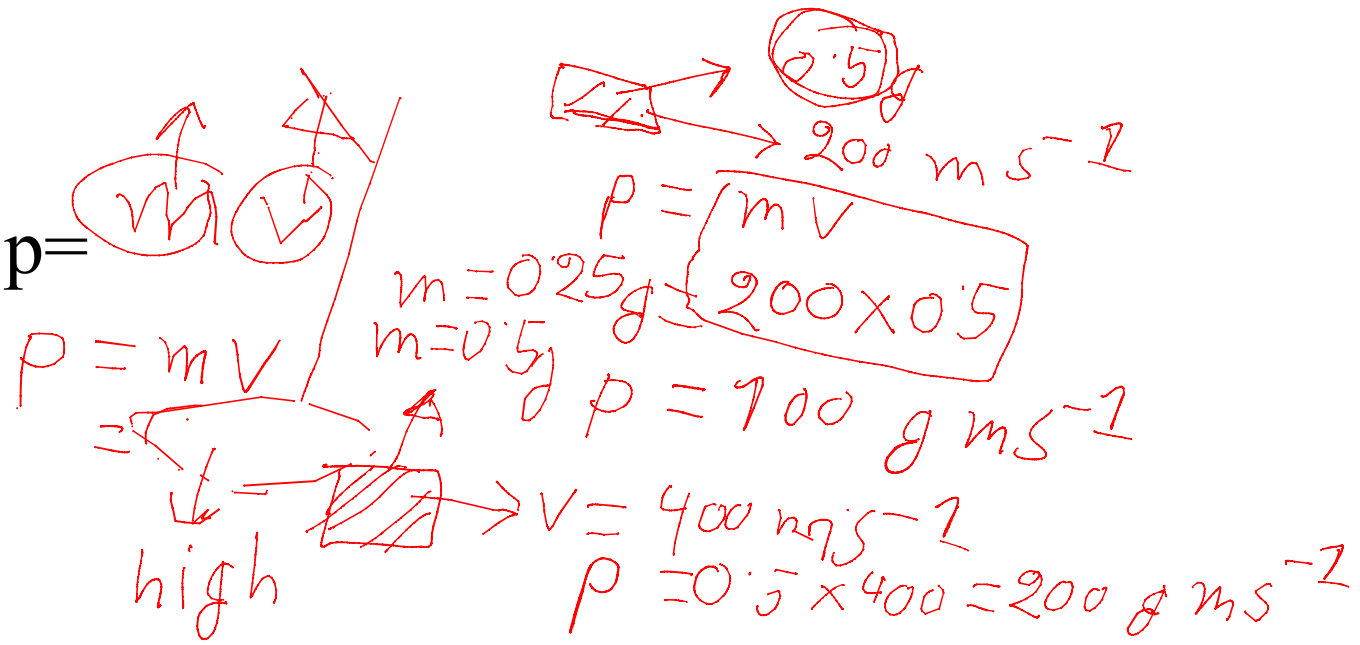
Structure of matter

Lecture :C-05



Momentum

- If the mass of the object is ‘m’ and velocity of the object is ‘v’
- Then , momentum p=

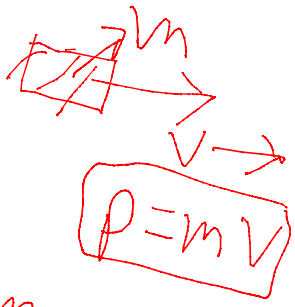


Angular momentum

- If the mass of the object is ‘m’ and velocity of the object is ‘v’

v = velocity

m = mass = m



- Then,

p = mv

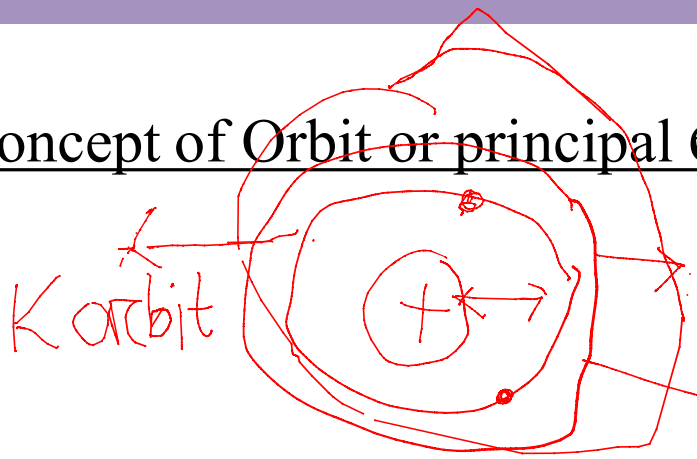
L = linear momentum x r

Angular momentum

L = mvr

Bohr's atomic model

Concept of Orbit or principal energy level : 1913



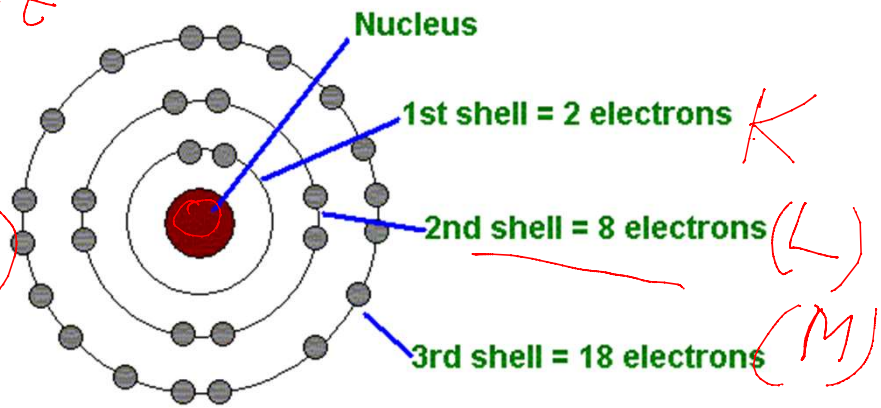
orbit/shell/principal quantum number

$2n^2$ =

$n = 1, 2, 3, \ldots$ etc

$n=1 \rightarrow 2n^2 = 2$

$n=2 \rightarrow 2n^2 = 8$

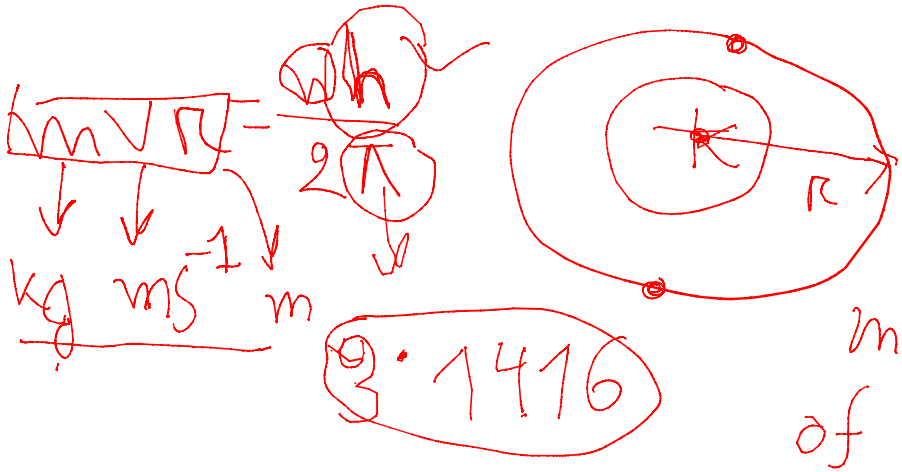


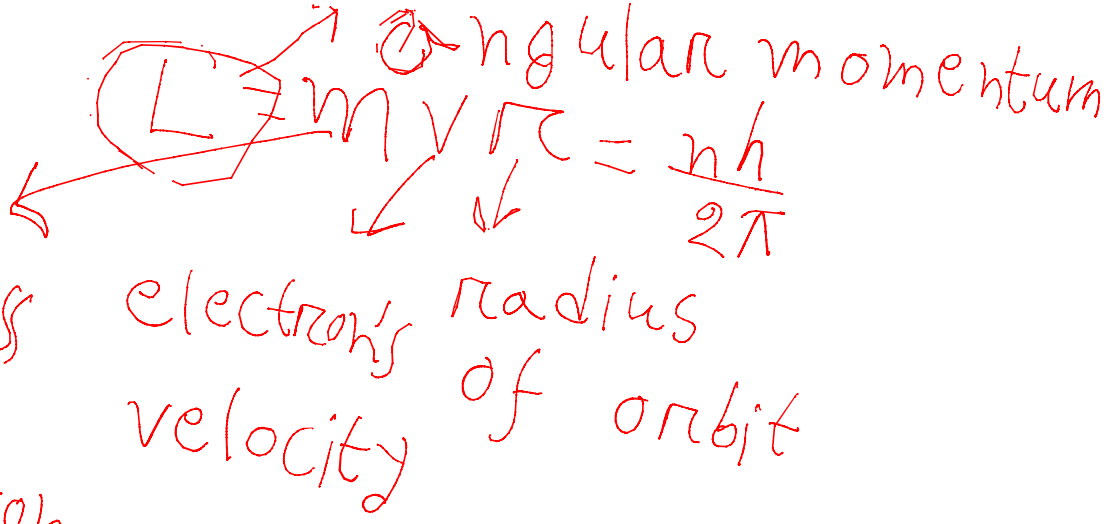
K

(L)

(M)

Momentum of electron:

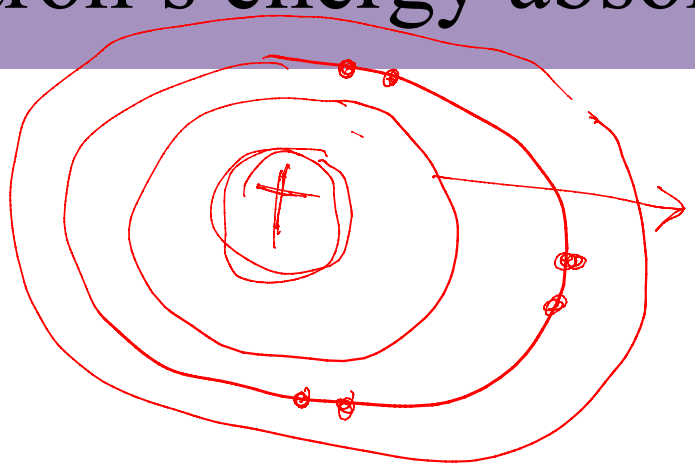




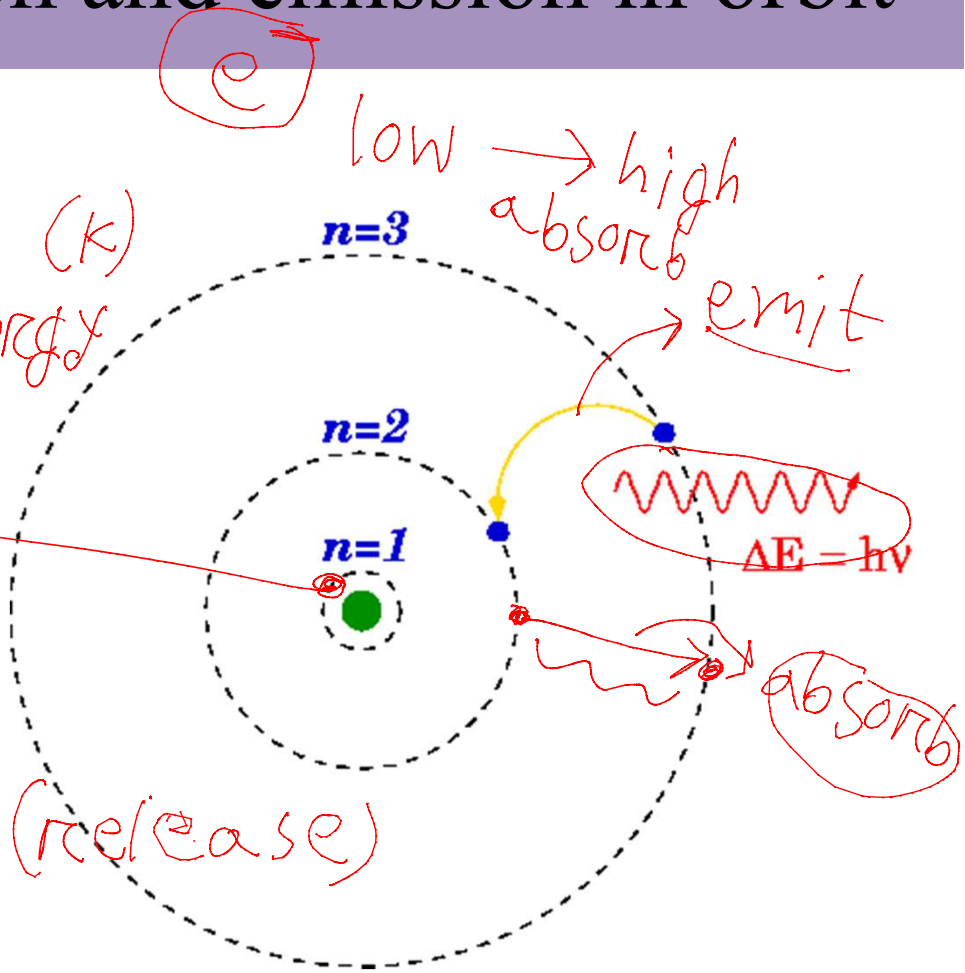
$n = 1, 2, 3, \ldots$ etc.

h = Plank's constant $= 6 \cdot 624 \times 10^{-34}$ kg m^2 s^{-2}

Electron's energy absorption and emission in orbit



h = 1 (k)
energy
law

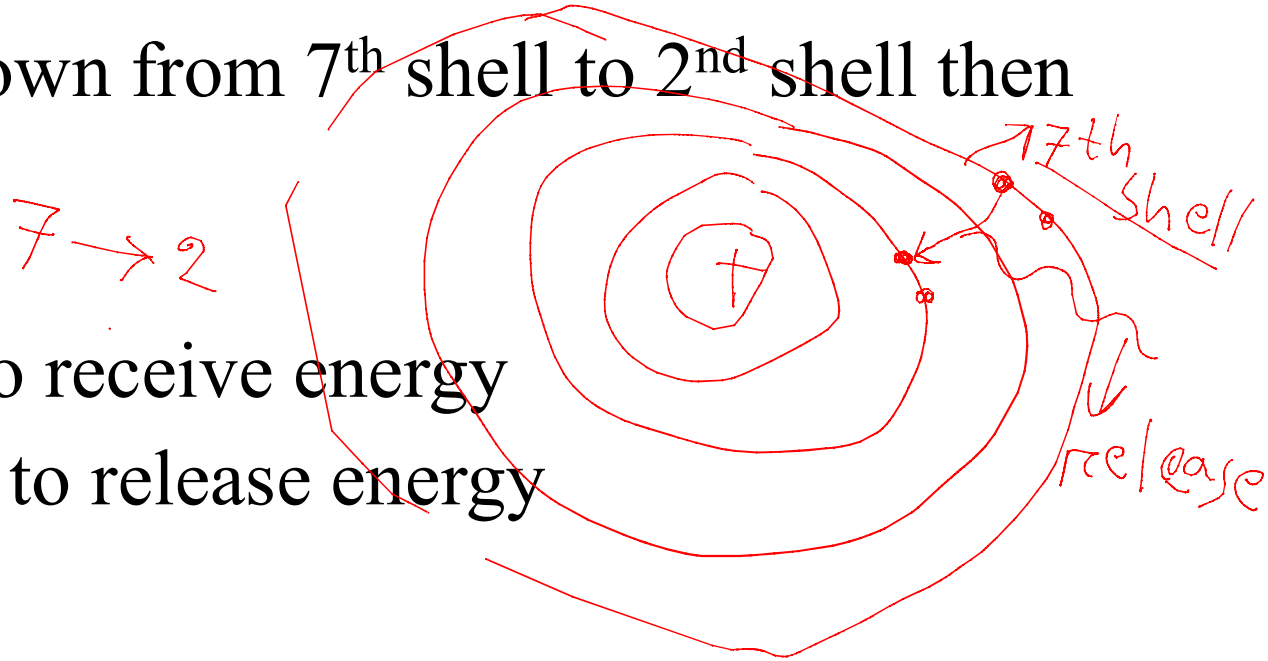


low → high absorb
emit
absorb

low → high (orbit)
energy → high
e⁻ high orbit → low orbit (release)

Poll question: 01

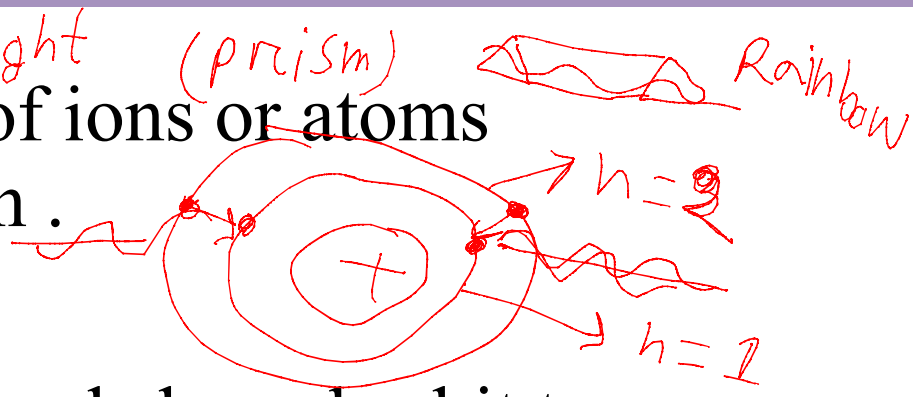
- If an electron goes down from 7^{th} shell to 2^{nd} shell then what will happen?



- i)electron will have to receive energy
- Ii)electron will have to release energy
- Iii) none of them

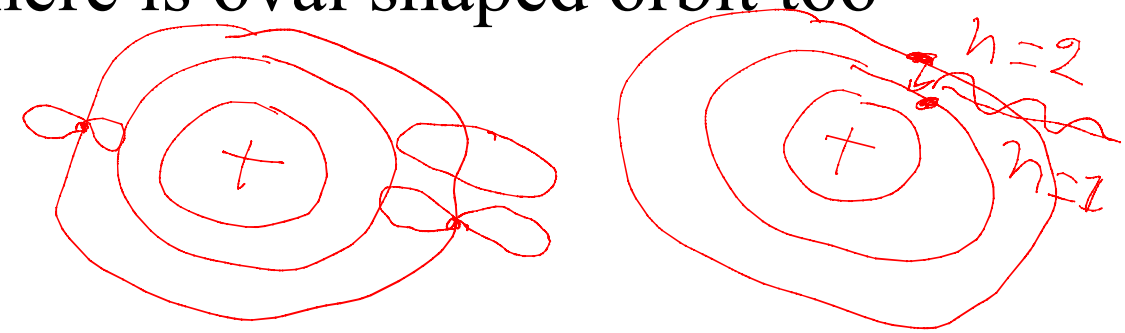
Limitation of Bohr's atomic model

1) Can not explain the spectrum of ions or atoms containing more than one electron .



2) Except circular orbit, there is oval shaped orbit too which is not explained

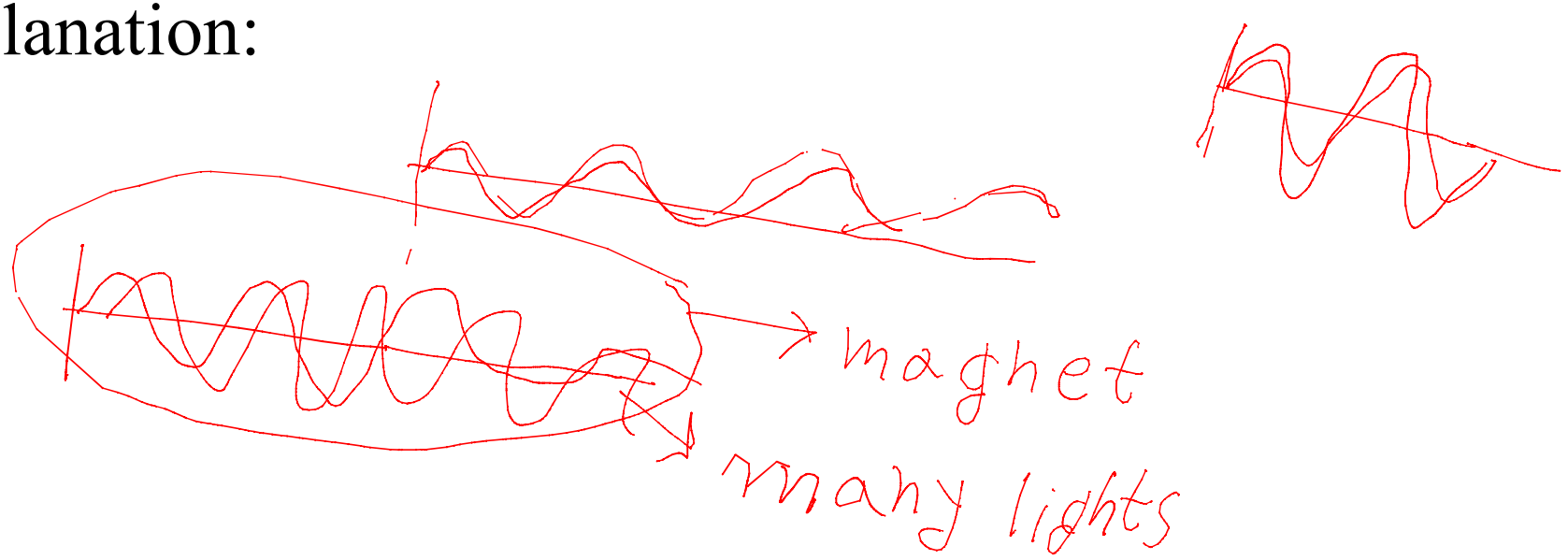
- by Bohr's model.



- 3) In spectrum , more than one line is seen.

3) In spectrum , more than one line is seen

Explanation:

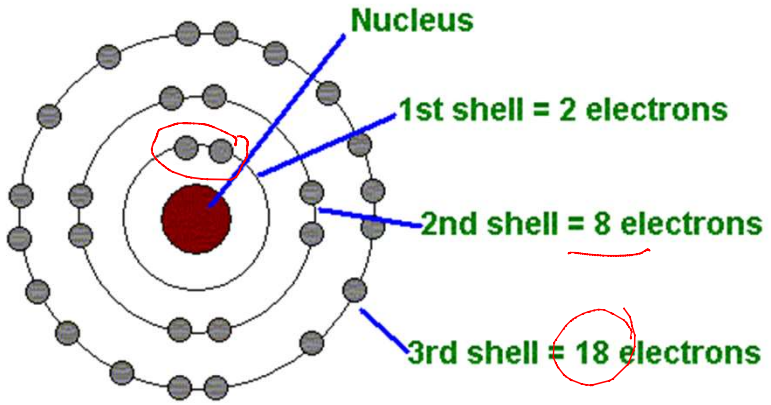


Electron configuration in orbit

Each orbit contains maximum $2n^2$ electron.

$n = 1 \quad 2n^2 = 2$

$n = 3 \quad 2n^2 = 18$



Poll question: 02

- What is maximum number of electron 4th shell can contain ?

$2n^2$

$n = 4$

$2 \times (4)^2 = 16 \times 2 = 32$

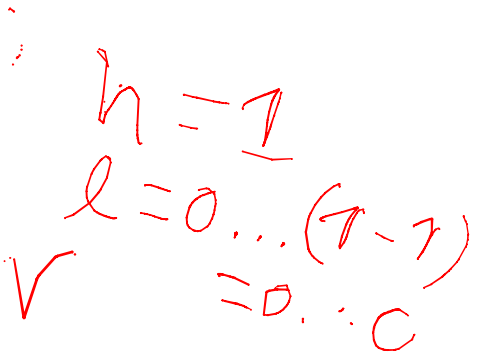
- i) 18
- ii) 32
- iii) 50
- iv) 64

Concept of sub level or orbital

- In orbit , the place where the probability of finding electron is high is called orbital

- The value of different sub levels depends on l.
- For any orbit (n) ,

l= from 0 to (n-1)



Name of orbitals

1s

2s 2p

3s 3p 3d

4s 4p 4d 4f

$l = 0 \ldots (n-1)$

$n = 3$

$l = 0 \ldots (3-1)$

$= 0 \ldots 2$

$= 0, 1, 2$

s p d

Expressing the value of orbit and sub level by n and l

$l = 0 \ldots (n-1)$

$n = 4$ $\quad l = 0 \ldots (4-1) = 0 \ldots 3$

$= 0, 1, 2, 3$

4s 4p 4d 4f

s p d f

Poll question: 03

- By n = 5 and l =1 which of the following orbital can be represented?

$l=0 \rightarrow s$

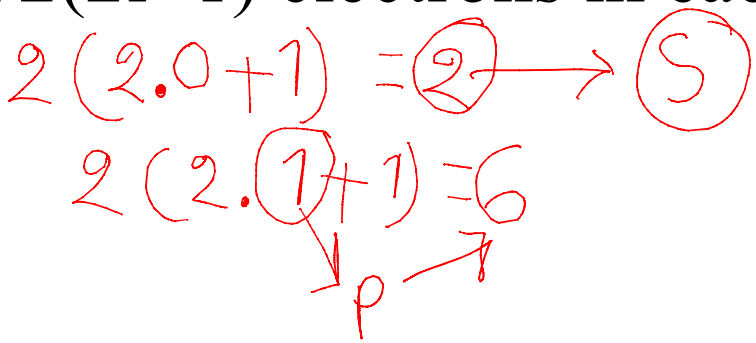
$l=1 \rightarrow p$

5p

- i) 4s
- ii) 5s
- iii) 5p
- iv) 4p

Electron configuration

- There can be maximum 2(2l+1) electrons in each sub level.



- For s → 2
- For p → 6
- For d → 10
- For f → 14

"Aufbau" principle

Electron will enter into the lower energy orbital first while entering in atom. Later, electron will enter into the higher energy orbital gradually.

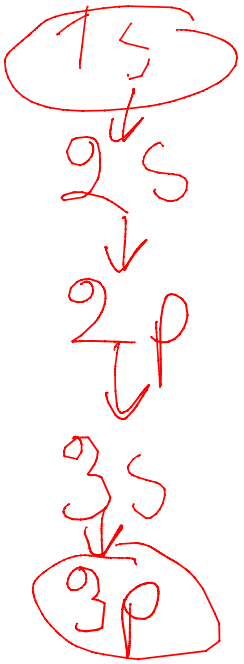
lower → higher

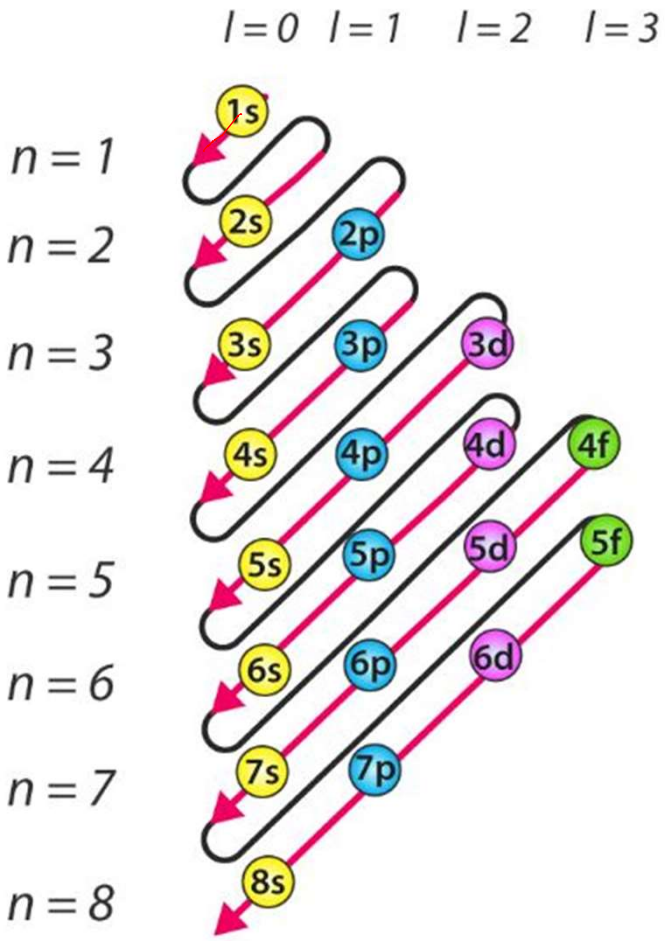
The energy of orbital depends on the value of (n+l)

“Aufbau” principle

- If the value of (n+l) is same for more than orbitals then ,

“Aufbau” principle





Poll question: 04

- In which orbital , 19th electron of K will enter into first ?

1. 3d
2. 4s
3. 4p
4. 4f

3d → (n+l) → (3+2) = 5

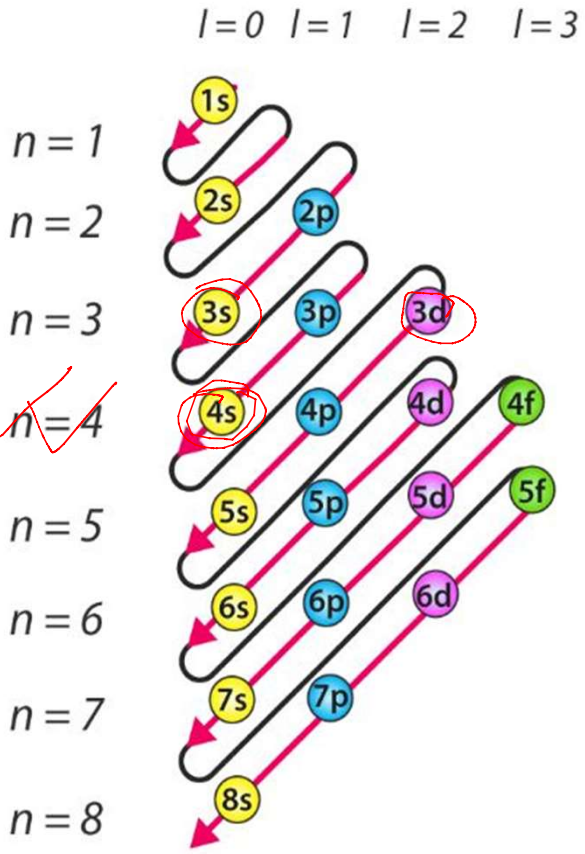
(4+0) = 4

(4+1) = 5

(4+3) = 7

Electronic configuration of different elements

- He(2)=
- N(7)=
- Na(11)=
- Cl(17)=
- Fe(26)=
- Zn(30)=



Poll question: 05

- Which one of the following is the correct electron configuration of F(9)?

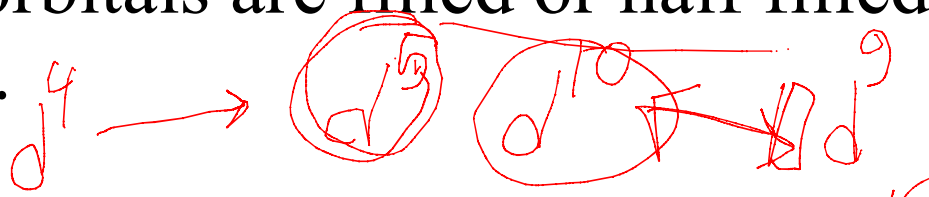
$F(9) = 1s^2\,2s^2\,2p^5$

9 − 4 = 5

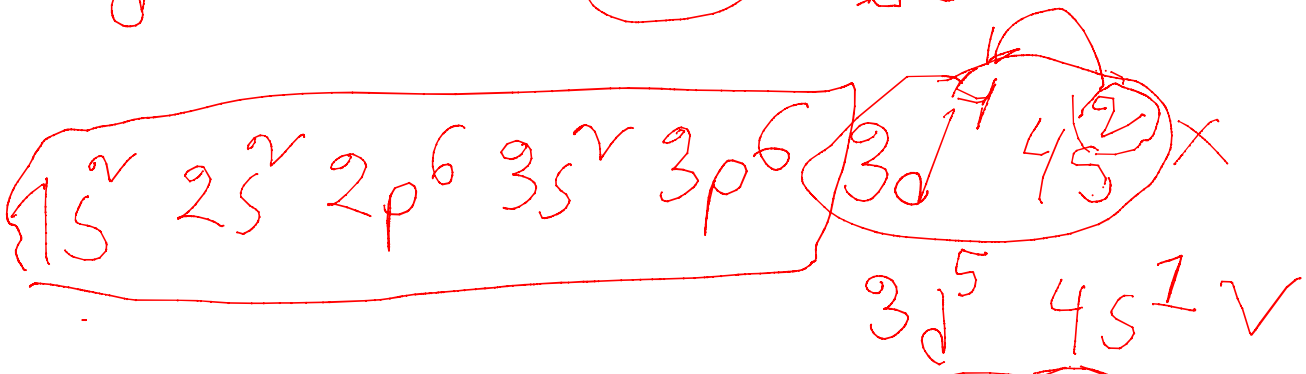
- i) $1s^2\ 2s^2\ 2p^6$
- ii) $1s^2\ \ 2s^2\ 2p^5$
- iii) $1s^2\ \ 2s^2\ 2p^4$
- iv) $1s^2\ \ 2s^2\ 2p^3$
-

Some exceptions in electronic configuration

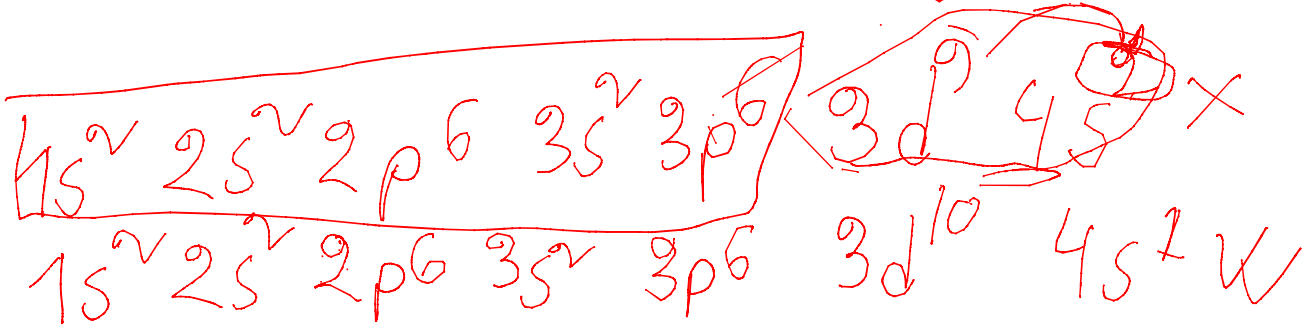
- If p and d orbitals are filled or half filled, they remains very stable .



- Cr(24)=



- Cu(29)=



Thank you everyone

উদ্ভাস উন্মেষ
শিক্ষা পরিবার

লেগে থাকো সৎভাবে,
স্বপ্ন জয় তোমারই হবে

ঊদ্ভাস-উন্মেষ শিক্ষা পরিবার

ঊদ্ভাস উন্মেষ
শিক্ষা পরিবার