Inorganic Chemistry

B.Sc Part-I, Group-B

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Quantum Numbers

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Lecture Notes series.-

1. Principle Quantum Number (n)

To Explain the various Spectra and to Provide a Complete description of an electron in an atom, following electrons are Present. It is denoted by n. As the distance of the electron from the nucleous increases, It's Energy becomes higher and higher.

Permitted value of 'n':

It may have any integral value from 1 to ∞ but 1 To 7 have so far have been established. The Letters K, L, M ... are also used To designate the value of n. The Maximum Thus

value of n	1	2	3	4	5	6	7	8
Shell Derination	K	L	M	N	O	P	Q	R
Max No of $\bar{e}$s $(2n)^2$	2	8	18	32	50	77	98	128

This Quantum no represents the size of the electron Shell. Mathamatically, It is related as

$$MVr \quad \frac{nh}{2\pi} \quad \text{———} \quad (1)$$

(2) Azimuthal Quantum Numer. (l) :-

It is denoted by 'l' and also called orbital quantum number or angular momentum quantum no or Secondary quantum number.

This quantum no determines the shape of the orbitals (electron cloud) occupied by the electron, the angular momentum of the electron round the nucleus and the fine structure in the hydrogen spectrum

Permitted values of 'l': For a given value of n, the azimuthal quantum no l may have any integral values from 0 to n-1 etc

$$l = 0, 1, 2 \ldots (n-2)\ (n-1)$$

The total no of different values of l is equal to n. Thus

(i) if $n=1$, $l=0$ (only one value)
(ii) If $n=2$ $l=0,1$ (only two value)
(iii) If $n=3$ $l=0,1,2$ (only three values)
(iv) If $n=4$ $l=0,1,2,3$ (only four values)

Total values of l for a given value of n gives the total no of sub-shells present in a main shell (eg K, L, M ...) eg $n=1$, $l=0$ shows that there is only one energy level in K-shell which is represented as 1s, similarly for $n=2$, $l=0,1$ shows that L shell is divided into two sub shells which are represented as 2s and 2p.

Different values of l, their

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Symbol and Shape are tabulated below,

Values of l	Sub-Shell	
0	S - Sharp	Spherical
1	P - Principles	Dumb - bell
2	d - (diffused)	Complicated
3	f - (fundamental)	Complicated

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