SUBJECT - CHEMISTRY
CLASS - BSc (Sub./GEN) PART - I
GROUP - B
TOPIC - PAULI's EXCLUSION PRINCIPLE
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Pauli's exclusion principle: This principle Simple places limitations on the values of quantum numbers. It States as "No two electrons in any atom Can have exactly the Same Set of four quantum numbers." As two men Cannot have exactly the Same address, Similarly any two electrons in an atom cannot have four quantum numbers quite identical. If two electrons agree in the first three quantum numbers then the fourth must be different. This means that every electron in atom differs from every other electrons in its total energy, and that there Can be as many electrons in each shell as there are possible Combinations of all the four quantum numbers. This much Can be Substantiated with the help of Carbon(6) as a typical example. Carbon atom is a p^2 System. i.e, two electrons are present in its Three p-orbitals. The two electrons of Carbon atom (according to Hund's rule) Can be accomodated in p-orbitals as [↑|↑|]
If we name 1st and 2nd electrons of 2p-orbitals of Carbon atom as A and B, respectively, then the four quantum numbers for Them Can be Calculated as -

Q. No	for A	for B
n	2	2
l	1	1
m	+1	0
s	$+\frac{1}{2}$	$+\frac{1}{2}$

We see that these two electrons [↑|↑|] differ in magnetic quantum number (m) values although all the other quantum numbers viz, n, l and s have the Same values. Hence they are in accordance with pauli's exclusion principle. Similarly for [↑↓| |] distribution the four quantum numbers are

Q.No	for A	for B
n	2	2
l	1	1
m	+1	+1
s	$+\frac{1}{2}$	$-\frac{1}{2}$

Since these two electrons differ in spin quantum number(s), hence they are also in accordance with Pauli's exclusion principle.

If we go on in the order of increasing atomic number in the periodic Table, we will find that the number of electrons in an atom of an element increasing by one in each step. The electronic configuration of the elements thus built up by successive addition of an electron to the preceding one in the Periodic Table. For the most stable state, the electron must be in the lowest possible energy level, subject to Pauli's exclusion principle. As atomic number increases, the electron should gradually fill up orbits and orbitals systematically. The quantum numbers of the electrons chosen are such as to place them in the most tightly bound state possible, reducing the potential energy of the atom to a minimum. Thus we see how a beautiful simple scheme explains the entire classification of the elements indicating the regular variation in their properties i.e chemical periodicity for the lowest possible energy level in Li(3), the 2-electrons of it shall be in K-shell and one electron in the 2s-orbital Thus Li should have a valency one which is a fact. It is easier to remove a 2s electron than an 1s electron from this atom which is a in agreement with the observed data. Li(3) $1s^2$ [↑↓] [↑| |]

2s 2p

This explains the inertness of the noble gases such as He, Ne, Ar Kr, Xe etc which are at the end of each period.

He -----→ $1s^2$ [↑↓]

Ne ----→ $1s^2 2s^2 2p^6$ [↑↓] [↑↓|↑↓|↑↓]

$2s^2$ $2p^6$

Ar ---- $3s^2 3p^6$ [↑↓] [↑↓|↑↓|↑↓]

$3s^2$ $3p^6$

Similarly, other chemical periodicity in properties of elements can also be explained.