Pauli exclusion principle :-

This is the most important principle which cannot be derived from any fundamental concept. We know that four quantum number are needed to define the energy of an electron in an atom. Wolf Gang Pauli put forward an ingenious principle which controls the assignment of value of four quantum numbers of an electron. It applies certain restrictions on the value for electron in an atom and hence the name exclusion principle.

Statement :- The principle can be stated in a number of ways:-

1) All electrons in any system must be distinguishable.
2) No electrons in a single atom can have all their quantum number identical.
3) No two electrons in atom can exist in the same quantum state.

All the above statement are identical and carry the same meaning that if two electrons posses the same value of n, l and m. they must have different values of s. Thus every electron in any atom differs from every other electron in a shell as there are possible arrangement of different quantum number. According to Pauli principle the electron entering same orbitals n, l and m. are identical should have opposite spins Thus this stable opposite side give a lower energy level state.

than. when the paring of electrons. with parallel. spins. According to thermodynamics. a. system having lower energy is maximum. stable. and therefore. the state. with. lower energy. opposite. spins is preferred. and. electrons entering. the same. orbital. must have spin in opposite direction.

(1)	(11)
opposite spin.	parallel spin.
lower energy.	more energy.
more stable.	less stable.

From. the above discussion. it follows. that no orbital can contain. more than two electrons. Therefore Pauli. principle. can be stated. in another way:- "Two electrons can occupy the same. orbital. only if there spins are opposed".

Application.

The. application. of this principle can be. demonstrated. by deriving the maximum. number of electrons that can be accommodated. by the cells defined by quantum. number having values of 1, 2, 3 ... so on. K - Shell. As the principle. quantum for. this shell is 1 and l and m. are zero. the. possible. values of four. quantum. numbers. can be. given as follows

Shell.	Quantum Numbers. n	l	m_l	m_s	No. of electrons in sub-shell	No. of electrons in complete shell
K	1	0	0	$+\frac{1}{2}$.	2	2.
	1	0	0	$-\frac{1}{2}$.		

Thus, the K-sub shell contains one s. sub shell ($l=0$). and thus the maximum number of electrons is 2.

L Shell. having principle quantum numbers can have two values of l (0,1) and m_l can have three values $-1, 0, +1$.

Shell	Quantum number. n	l	m_l	m_s	No. of electrons in sub-shell	No. of electrons in complete shell.
2L Shell.	2	0	0	$+\frac{1}{2}$.	2	8.
	2	0	0	$-\frac{1}{2}$.		
	2.	1	-1	$+\frac{1}{2}$.		
	2	1	-1	$-\frac{1}{2}$.		
	2	1	0	$+\frac{1}{2}$.	6	
	2	1	0	$-\frac{1}{2}$.		
	2	1	+1	$+\frac{1}{2}$.		
	2	1	+1	$-\frac{1}{2}$.		

Thus L shell is composed of s - sub-shell $l=0$ which can have two electrons and p sub-shell $l=1$. which can have six electrons.

Therefore L shell can accommodate ... electrons

M shell as the value of principle quantum ... is 3 l can have value 0, 1, 2. The ... of m_l l=2 will be -2, -1, 0, +1, +2.
Thus M-shell is composed of three sub ...
s = sub-shell (corresponding l=0 m_l ...
contains 2 electrons.
p-sub shell corresponding l=1, m_l = ...
containg 6 electrons
d-sub shell corresponding to l=2.
m_l = -2, -1, 0 +1, +2.
containg 10 electrons.
Therefore the total number of electro ...
M-shell is 18.
Similarly one calculate the maximum ... number of electrons in N-th shell. N= ...
which can have 32 electrons.

From the above discussion it is cl ...
that the capacity of s-sub shell is 2 ...
electrons while p, d and f sub she ...
is 6, 10, 14 electrons respectively ...