

Atomic Structure Part - 2

Quantum Numbers- To describe each electron in atom in different orbital we need quantum number to provide complete information of electron in atom.

There are four types of Quantum no. -

① Principle Quantum Number - This quantum no. determine the main Energy shell in which the electron is present. It is represented by n .

Shell	K	L	M	N
n	1	2	3	4

② Angular Momentum Quantum Number - This quantum no. determine the Angular Momentum of electron. It describe the shape of orbital. It is represented by l
Value of $l = 0$ to $(n-1)$

Ex - $n=1$, $l=0$
 $n=2$, $l=0,1$
 $n=3$, $l=0,1,2$

Subshell \rightarrow s p d f g h
 $l \rightarrow 0 \quad 1 \quad 2 \quad 3 \quad 4 \quad 5$



n	l	Subshell
1	0	1s
2	0 1	2s 2p
3	0 1 2	3s 3p 3d
4	0 1 2 3	4s 4p 4d 4f

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③ Magnetic Quantum Number - This quantum no. describe the behaviour of electron in magnetic field. It gives the no. of orbital in a given subshell. It is represented by m . The value of m is $-l$ to l

Ex- for $l=1$ $m = -1$ to $1 = -1, 0, 1$
 ① So p subshell has \rightarrow 3 orbitals (p_x, p_y, p_z)

② for $l=2$ $m = -2$ to $2 = -2, -1, 0, 1, 2$
 So d subshell has \rightarrow 5 orbitals

Note Total values of $m = 2l + 1$

Eg- for $l=1$, $m = 2 \times 1 + 1 = 3$

One orbital has max 2 electrons.

Subshell Subshell	no. of orbitals	Max electrons
s	1	$1 \times 2 = 2$
p	3	$3 \times 2 = 6$
d	5	$5 \times 2 = 10$
f	7	$7 \times 2 = 14$



④ Spin Quantum Number - This quantum no. describe the spin orientation of electron. It is represented by s or m_s . It has

two values = $+\frac{1}{2}, -\frac{1}{2}$.

for up

↑

$s = +\frac{1}{2}$
 or m_s

for down

↓

$s = -\frac{1}{2}$
 or m_s

Electronic Configuration of atom (On the basis of Subshell) - According to following Principle-

Aufbau Principle - According to this principle in the ground state of an atom an electron enter the orbital of lowest energy first and subsequent electron are filled in the order of increasing energy.

1s				
2s	2p			
3s	3p	3d		
4s	4p	4d	4f	
5s	5p	5d	5f	5g
6s	6p	6d	6f	
7s	7p	7d		

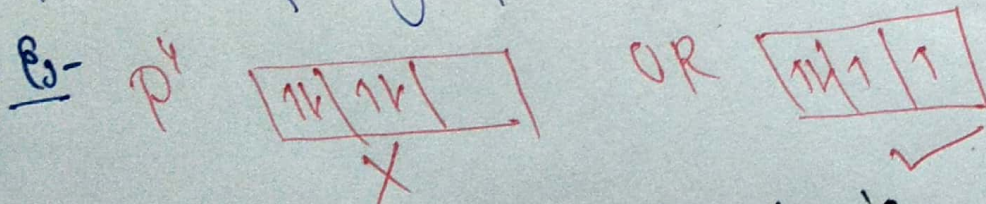


$1s < 2s < 2p < 3s < 3p < 4s < 3d < 4p < 5s < 4d < 5p < 6s < 4f < 5d < 6p < 7s < 5f < 6d < 7p$ --- And so on.

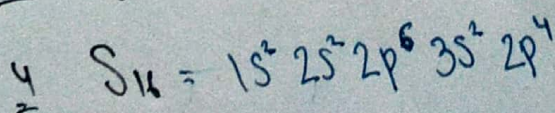
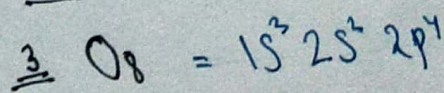
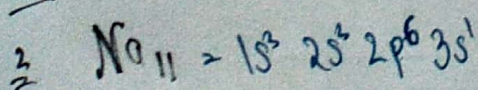
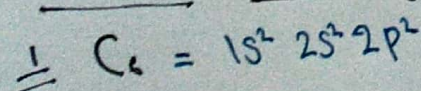
Pauli Principle - According to this principle no two electron in an atom can have same values for all four quantum numbers.

Hund Rule - According to this rule electron pairing will not take place in the orbital of same energy with each is singly filled.

OR
One electron goes into each orbital untill all of them are half full before pairing up.



Electronic Configuration of some elements-



$$\underline{5} \text{ Cr}_{24} = 1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^4$$

$$\underline{6} \text{ Cu}_{29} = 1s^2 2s^2 2p^6 3s^2 3p^6 4s^1 3d^{10}$$

$$\underline{7} \text{ Ag}_{47} = 1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^6 5s^1 4d^{10}$$

$$\underline{8} \text{ Au}_{79} = 1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^6 5s^2 4d^{10} 5p^6$$

(Gold) = $6s^2 4f^{14} 5d^{10}$

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