

# Concept of Vector Atom Model:—

The vector atom model is based on the following two concepts:—

- (a) The concept of electron spins
- (b) " " " " space quantisation

The Quantum Theory suggests that the orbital and spin motion of the electron are to be quantised both in magnitude as well as in direction. It implies that the angular and spin magnetic momenta associated with the orbital and spin motions of the electron are vector quantities. All the quantities which determine the state of the atom are quantised vectors, the atom model so designed is called the vector atom model.

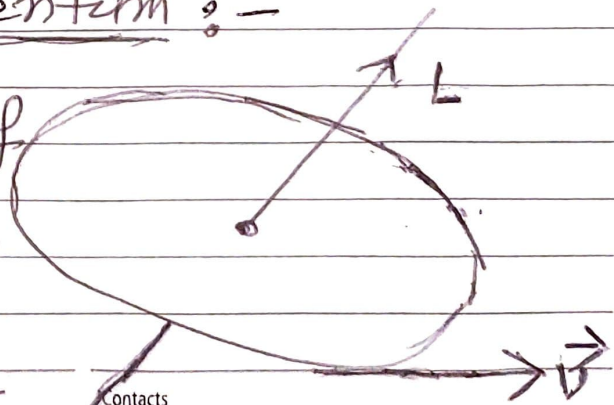
## Orbital Angular Momentum:—

If  $r$  be the radius of the orbit of an atomic electron then its associated angular momentum

$$L, \quad L = M v r \quad \text{--- (1)}$$

In accordance with Bohr's theory, the magnitude of  $L$  is quantised and is an integral multiple of  $h$ . Thus,

$$L = n h \quad \text{--- (2)}$$



In Sommerfeld's theory the angular momentum is represented by  $P_{\phi} = n\hbar$ .

In vector atom model  $n\hbar$  is represented by  $l$  and is called orbital quantum number;

$$\therefore P_{\phi} = l\hbar, \text{ where, } l = 0, 1, 2, \dots (n-1)$$

The quantum states with different  $l$  values and their designation are shown in the given table below: —

Orbital Quantum Number	0	1	2	3	4	5
Designation of the states	s	p	d	f	g	h

The angular momentum is a vector quantity which is directed along the axis of rotation and is  $\perp$  to the plane of the orbit of the electron as shown in the last page.