

4. If  $l_x$ ,  $l_y$  and  $l_z$  are direction cosines of a point, in what direction will the orbital given by  $l_x p_x + l_y p_y + l_z p_z$  lie?

Position vector of the point,  $\vec{v} = l_x \hat{x} + l_y \hat{y} + l_z \hat{z}$

where  $\hat{x}$ ,  $\hat{y}$ ,  $\hat{z}$  are unit vectors along the three cartesian directions.

$\therefore p_x$  orbital lies along  $\hat{x}$   
 $p_y$  " " similarly lies along  $\hat{y}$   
 $p_z$  " " " " " " " "  $\hat{z}$

$\therefore l_x p_x + l_y p_y + l_z p_z$  lies along  $\vec{v}$ .

Construct a p-orbital that lies along the body diagonal of the cube ~~that~~ with the three cartesian directions as its sides.