

8.25) a) DRAW A VECTOR MODEL DIAGRAM FOR ANGULAR MOMENTUM WITH $l=3$

b) HOW MANY POSSIBLE ORIENTATIONS ARE THERE?

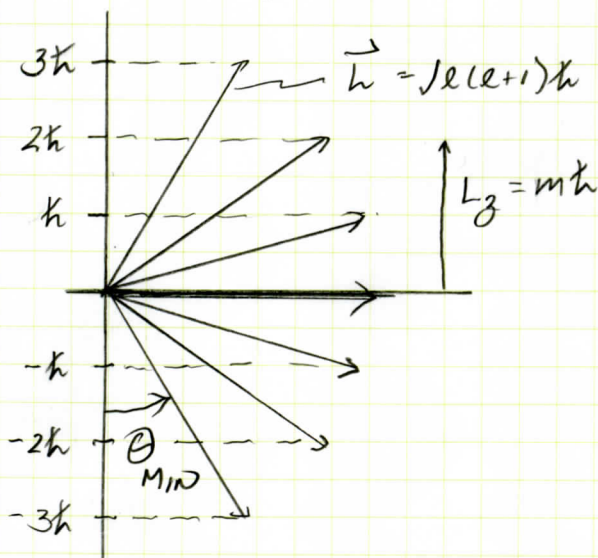
c) WHAT'S THE MINIMUM ANGLE BETWEEN \vec{L} AND \hat{z} ?

a) THE MAGNITUDE OF THE ANGULAR MOMENTUM VECTOR IS

$$|\vec{L}| = \sqrt{l(l+1)}\hbar = \sqrt{3(3+1)}\hbar = \sqrt{12}\hbar \approx 3.5\hbar$$

THE z -COMPONENT HAS VALUES OF $m\hbar$, $m = -l, \dots, 0, \dots, l$

$$L_z = -3\hbar, -2\hbar, -\hbar, 0, \hbar, 2\hbar, 3\hbar$$



b) FROM ABOVE, THERE ARE SEVEN POSSIBLE ORIENTATIONS OF \vec{L} .

c) THE MINIMUM ANGLE BETWEEN \vec{L} & \hat{z} IS

$$\cos \theta_{\min} = \frac{L_{z, \max}}{|\vec{L}|}$$

$$\cos \theta_{\min} = \frac{3\hbar}{\sqrt{12}\hbar} = \frac{\sqrt{3}}{2}$$

$$\Rightarrow \theta_{\min} = \cos^{-1}\left(\frac{\sqrt{3}}{2}\right)$$

$$\boxed{\theta_{\min} = 30^\circ}$$