38-2 :- Addition of anguler momenta

$$S_{\pm} |s\, m\rangle = \hbar \sqrt{s(s+1) - m(m-1)}\; |s \quad m \pm 1\rangle$$

$$S_{-} |s\, m\rangle = \hbar \sqrt{s(s+1) - m(m-1)}\; |s \quad m - 1\rangle$$

$\Rightarrow \underbrace{S_{-}^{(1)} \uparrow}$: m is denoted as a positive quantum value

$S_{-} |s\, m\rangle$ [overall spin state goes up]

$$= \hbar \sqrt{s(s+1) - m(m-1)}\; |s \quad m - 1\rangle$$

⊛ $S = \frac{1}{2}$ because of the positive quantum value

$$\hbar \sqrt{\tfrac{1}{2}\left(\tfrac{3}{2}\right) - \left[\tfrac{1}{2}\left(-\tfrac{1}{2}\right)\right.}\; \left|\tfrac{1}{2} \quad \tfrac{1}{2} - 1\right\rangle$$

$$= \hbar \sqrt{\left(\tfrac{3}{4}\right) - \left(-\tfrac{1}{4}\right)}\; \left|\tfrac{1}{2} \quad -\tfrac{1}{2}\right\rangle$$

$$= \hbar \sqrt{\left(\tfrac{4}{4}\right)}\; \left|\tfrac{1}{2} \quad -\tfrac{1}{2}\right\rangle$$

$$= \hbar (1) \underbrace{|\chi_{-}|}\; \downarrow$$

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