

S-1: I can apply the fundamental properties of the angular momentum operators and use and interpret their eigenstates.

Unsatisfactory

Progressing

Acceptable

Polished

- (1) Verify the uncertainty relationship for J_x and J_y when the state of the system is $|j, m\rangle$. In other words, show that

$$(\Delta J_x)^2 (\Delta J_y)^2 \geq \left(\frac{\langle [J_x, J_y] \rangle}{2i} \right)^2.$$

You are free to use any results from the course notes or homework, of course; you don't have to re-derive them!

- (2) Do all the states $|j, m\rangle$ have the same uncertainty? If not, how does the uncertainty vary with m ? Which values of m have the largest or smallest uncertainty?