

Physics 212 - Quiz #7
Chapter 8

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Name: _____ Key _____ Id#: _____

Q1.

(a) Give the spectroscopic notation for an electron in the following state: $n = 5, l = 4, j = 7/2$.

$$l = 4 \rightarrow G \text{ state} \Rightarrow \boxed{5G_{7/2}}$$

(b) What is the magnitude of the total angular momentum for the above state?

$$\begin{aligned} \text{Since } j = 7/2 \Rightarrow |\vec{J}| &= \sqrt{j(j+1)} \hbar \\ &= \sqrt{7/2(7/2+1)} \hbar = \boxed{\frac{\sqrt{63} \hbar}{2}} \end{aligned}$$

Q2.

(a) Consider a spin 1 particle. What is the magnitude of the spin angular momentum?

$$s = 1 \Rightarrow |\vec{S}| = \sqrt{s(s+1)} \hbar = \sqrt{2} \hbar$$

(b) Calculate the angles between the z-axis and the spin angular momentum.

$$\cos \theta = \frac{S_z}{|\vec{S}|} = \frac{m_s \hbar}{\sqrt{2} \hbar} = \frac{m_s}{\sqrt{2}}$$

$$-s \leq m_s \leq s \Rightarrow m_s = -1, 0, 1$$

The possible orientations are:

$$\Rightarrow \theta_1 = \cos^{-1} \left(-\frac{1}{\sqrt{2}} \right) = 135^\circ$$

$$\theta_2 = \cos^{-1} (0) = 90^\circ$$

$$\theta_3 = \cos^{-1} \left(\frac{1}{\sqrt{2}} \right) = 45^\circ$$