Assignment 11

The due date for submitting this assignment has passed. As per our records you have not submitted this assignment. Due on 2019-04-17, 23:59 IST.

1) The allowed angular momentum \( j \) when we add two particles with angular momentum \( j_1 = 5/2 \) and \( j_2 = 3/2 \) are

- 0,1,2,3,4
- 1/2, 3/2,5/2
- 1,2,3,4
- 7/2,5/2,3/2

No, the answer is incorrect. Score: 0
Accepted Answers:
1,2,3,4

2) The Clebsch-Gordan coefficient \( \{m_1 = j_1 - 1, m_2 = -j_2 + 3, j = j_1 + j_2, m\} \) will be non-zero if

- \( m = j_1 + j_2 - 3 \)
- \( m = j_1 + j_2 \)
- \( m = j_1 - j_2 + 2 \)
- \( m = j_2 - 1 - j_1 \)

No, the answer is incorrect. Score: 0
Accepted Answers:

3) The matrix element of \( z \) between \( 4F \) and \( 4D \) hydrogen states is given

- \( m = j_1 - j_2 + 2 \)

1 point
4) The matrix element $\langle \ell, m_1 | \hat{L}_x | \ell, m_2 \rangle$ will be

- zero if $|m_1 - m_2| \geq 3$
- non-zero if $m_1 = m_2 \pm 1$
- non-zero if $m_1 = m_2 \pm 2$
- zero if $m_1 = m_2$

No, the answer is incorrect.
Score: 0
Accepted Answers:
$-i a_0$

5) Consider two electrons in an atomic D state in the absence of any external field. Taking the values of $L$, $S$ and $J$ for the combined two-electron system, which of the following states are allowed?

- $^3 P_0, ^3 P_1, ^3 P_2$
- $^3 D_1, ^3 D_2, ^3 D_3$
- $^1 P_1, ^1 P_2, ^3 P_2$
- $^1 D_0, ^1 D_1, ^3 D_2$

No, the answer is incorrect.
Score: 0
Accepted Answers:
$^3 P_0, ^3 P_1, ^3 P_2$

6) The product of the position vector component $xyz$ in terms of spherical rank two tensor component $T^{(2)}_{mj}$ will be

- $-\frac{1}{3} (T^{(2)}_{+2} - T^{(2)}_{-2})$
- $-\frac{1}{3} (T^{(2)}_{+2} - T^{(2)}_{-2})$
7) Let \( O(j, s) \) be a rank \( j \) tensor operator. For \( j = 1/2 \) you are given \( \langle 3/2, 1/2 | O(j, 1/2) | 1, -1 \rangle = A \). Then \( \langle 3/2, -3/2 | O(j, -1/2) | 1, -1 \rangle \) will be

\[
\begin{align*}
\frac{1}{\sqrt{3}} A \\
\frac{2}{\sqrt{3}} A \\
3 A \\
\sqrt{3} A
\end{align*}
\]

No, the answer is incorrect.
Score: 0
Accepted Answers:
\[-\frac{i}{2} (T_{1/2}^{(2)} - T_{-1/2}^{(2)})\]

8) The reduced matrix element \( \langle 2 \parallel Y_1 \parallel 1 \rangle \), calculating the expression \( \langle 2, 0 | Y_{10} | 1, 0 \rangle \) along with the Wigner-Eckart theorem will be

\[
\begin{align*}
\sqrt{\frac{1}{5 \pi}} \\
\sqrt{\frac{3}{10 \pi}} \\
\sqrt{\frac{2}{30 \pi}} \\
\sqrt{\frac{6}{5 \pi}}
\end{align*}
\]

No, the answer is incorrect.
Score: 0
Accepted Answers:
\[\sqrt{\frac{3}{10 \pi}}\]

9) If an electron in orbital angular momentum state \( \ell = 2 \), then the CG coefficient \( \langle j = 5/2, m_1 = 1/2 | m_1 = \ell - 1, m_2 = -1/2 \rangle \) will be

\[
\begin{align*}
\sqrt{\frac{2}{5}} \\
-\sqrt{\frac{2}{5}}
\end{align*}
\]

1 point
10. The maximum degeneracy of states when we add angular momentum $j_1 = 4$ and $j_2 = 2$ is

- 2
- 4
- 9
- 5

No, the answer is incorrect.
Score: 0
Accepted Answers:
$\frac{2}{5}$