July 7 Problems

Created: 2022-07-07

9.1: What information is contained in the term symbol ${}^2D_{\frac{3}{2}}$?

1. Total Orbital Angular Momentum $(l) = 2$ if D
2. Spin Multiplicity = Doublet
3. Russell-Saunders Coupling (J) $= \dfrac{3}{2}$
4. Total Spin Angular Momentum (S) $= \dfrac{1}{2}$

9.2: Which of the following transitions are allowed in the normal electronic emission spectrum of an atom? For those which are not allowed, explain why.

$$a) {}^2D_{\frac{3}{2}} \rightarrow {}^2S_{\frac{1}{2}}$$
$$b) {}^1D_0 \rightarrow {}^1S_0$$
$$c) {}^3P_0 \rightarrow {}^3S_1$$
$$a) {}^3D_3 \rightarrow {}^1D_1$$

a)

$$\text{Conditions: } \begin{array}{ll} \Delta L = \pm 1 & \text{False} \\ \Delta S = 0 & \\ \Delta J = 0, \pm 1 \text{ except (J=0 to J=0)} & \end{array}$$

$$\boxed{\therefore \text{This is not an allowed transition}}$$

b)

$$\text{Conditions: } \begin{array}{ll} \Delta L = \pm 1 & \text{False} \\ \Delta S = 0 & \\ \Delta J = 0, \pm 1 \text{ except (J=0 to J=0)} & \end{array}$$

$$\boxed{\therefore \text{This is not an allowed transition}}$$

c)

$$\text{Conditions: } \begin{array}{lll} \Delta L = \pm 1 & \text{True} & \\ \Delta S = 0 & \text{True} & \\ \Delta J = 0, \pm 1 \text{ except (J=0 to J=0)} & & \text{True} \end{array}$$

$$\boxed{\therefore \text{This is an allowed transition}}$$

d)

$$\text{Conditions: } \begin{array}{ll} \Delta L = \pm 1 & \text{False} \\ \Delta S = 0 & \\ \Delta J = 0, \pm 1 \text{ except (J=0 to J=0)} & \end{array}$$

$$\boxed{\therefore \text{This is not an allowed transition}}$$