Daily Tutorial Sheet 11	Numerical Value Type for JEE Main

126.(2) Given 40% of the absorbed energy is reemitted. Let n_1 be the number of quanta absorbed and n_2 be the number of quanta emitted.

$\Rightarrow \quad n_1 \dfrac{hc}{\lambda_1} \times \dfrac{40}{100} = \dfrac{n_2 hc}{\lambda_2}$

$\Rightarrow \quad \dfrac{n_1}{\lambda_1} \times 0.4 = \dfrac{n_2}{\lambda_2}$

$\Rightarrow \quad \dfrac{n_1}{n_2} = \dfrac{\lambda_1}{\lambda_2} \times \dfrac{10}{4} = \dfrac{400}{500} \times \dfrac{10}{4} = 2$

127.(7) $Cu_{(29)} = 1s^2 2s^2 2p^6 3s^2 3p^6 4s^1 3d^{10}$

$\ell = 0 \Rightarrow$ S – subshell

Total electrons in S-subshell = 7

128.(1) State A $\xrightarrow{\text{excitation}}$ State B

1 radial node — one radial node

$E_B = -13.6$ eV $\ell = ?$

For Li^{+2}

$E_n = \dfrac{-13.6(9)}{n^2}$

Thus n = 3 for state B

Also $n - \ell - 1 = 1 \Rightarrow 3 - \ell - 1 = 1 \Rightarrow \ell = 1$

129.(9) Total electrons present in a shell = $2n^2$

For $n = 3$, total electrons $= 18$

Now half of the electrons will have $m_s = +1/2$ and others will have $m_s = -1/2$

$\therefore$ Max electrons with $m_s = -1/2$ in n = 3 will be 9.

130.(10) Maximum no. of electrons having n = 4 and $\ell = 2$ are 10

$\ell = 0$ to n – 1

For n = 4 $\ell = 0, 1, 2, 3$

Total electrons that can be accommodated in a subshell $= 2(2\ell + 1)$

$= 2(5) = 10$

131.(10) Energy given = 99% (IE)

$= \dfrac{99}{100} \times 13.6\,\text{eV}$

Let the electron jump from ground state to nth state on absorbing the given energy.

$\Rightarrow \quad E_n - E_1 = 0.99 \times 13.6\,\text{eV}$

$\Rightarrow \quad 13.6\left(\dfrac{1}{1^2} - \dfrac{1}{n^2}\right) = 0.99 \times 13.6$

$\Rightarrow \quad 1 - \dfrac{1}{n^2} = 0.99$

$\Rightarrow \quad n^2 = 100$

$\Rightarrow \quad n = 10$

132.(4) Let the electron jumps from first excited state (n = 2) to n = n.

De-Broglie wavelength of e^- in nth orbit = $13.4\,\overset{o}{A}$

$$\Rightarrow \quad \frac{h}{mv} = 13.4\,Å$$

$$\Rightarrow \quad \frac{6.6 \times 10^{-34}}{9.1 \times 10^{-31}\,kg \times V_n} = 13.4 \times 10^{-10}\,m$$

$$\Rightarrow \quad V_n = 0.54 \times 10^6 \ ms^{-1}$$

$$\Rightarrow \quad 2.18 \times 10^6 \frac{z}{n} = 0.54 \times 10^6 \qquad (Z = 1 \text{ for H})$$

$$\Rightarrow \quad n = \frac{2.18}{0.54} = 4$$

133.(5) $\Delta E_{2\to3} = 47.2\,eV$

$$\Rightarrow \quad 13.6Z^2\left(\frac{1}{4} - \frac{1}{9}\right) = 47.2$$

$$\Rightarrow \quad Z^2 = \frac{47.2}{13.6} \times \frac{36}{5}$$

$\Rightarrow \quad Z^2 = 25$

$\Rightarrow \quad Z = 5$

134.(2) $13.6Z^2\left(\frac{1}{1} - \frac{1}{4}\right)eV = \frac{hc}{\lambda}$

$$\Rightarrow \quad 13.6 \times 1.6 \times 10^{-19} Z^2 \times \frac{3}{4} = \frac{6.626 \times 10^{-34} \times 3 \times 10^8}{3 \times 10^{-8}}$$

$\Rightarrow \quad Z^2 = 4 \ \Rightarrow \ Z = 2$

135.(2) M-shell $\Rightarrow$ n = 3

$\ell = 0$ to $n - 1$

$\Rightarrow \quad \ell = 0, 1, 2$

Zero nodal planes will be present in 3s and $3dz^2$ orbital.

136.(6) $Fe^{+2} = [Ar]3d^6$

Number of electrons in d-orbital = 6

137.(8) Uncertainty in position = uncertainty in momentum $= \Delta x$

$$\Rightarrow \quad \Delta x^2 = \frac{h}{4\pi}$$

$$\Rightarrow \quad \Delta x = \sqrt{\frac{h}{4\pi}}$$

Also $\quad \Delta x \cdot m\Delta v = \frac{h}{4\pi}$

$$\Delta v = \frac{h}{4\pi m\,\Delta x}$$

$$= \frac{h}{4\pi m} \cdot \sqrt{\frac{4\pi}{h}}$$

$$= \sqrt{\frac{h}{4\pi}} \cdot \frac{1}{m}$$

$$= \sqrt{\frac{6.6\times10^{-34}}{4\times3.14}} \times \frac{1}{9.1\times10^{-31}}$$

$$= 8\times10^{-12}\,\text{ms}^{-1}$$

$\Rightarrow \quad x = 8$

138.(5) Total nodes = n – 1

$3p_x, 3d_{xy}$, $3d_{z^2}, 4p_z$ and $4d_{x^2-y^2}$ have more than 1 node

139.(4) Total number of waves made by electron = orbit number

$\Rightarrow$ total waves = 4

140.(0) Orbital angular momentum $= \sqrt{\ell(\ell+1)}\,\dfrac{h}{2\pi}$

For 4s orbital $\ell = 0$

$\Rightarrow$ orbital angular momentum = 0

141.(9) For H-like species energy only depends on the value of 'n' and not on 'ℓ'

Thus all the orbital belonging to same shell will be degenerate.