ARJUNA NEET BATCH

Atomic Structure

DPP-09

1. Orientation of orbitals is given by

(A) Magnetic quantum number (m_l)

(B) Spin quantum number (m_s)

(C) Azimuthal quantum number (l)

(D) Principal quantum number (n)

p subshell

$m =$ p_x p_y p_z

orientation.

(1) $n \rightarrow$ orbit/shell number

(2) $l =$ subshells

(3) $m_l =$ orbitals (preffered orientation]

(4) $m_s \rightarrow$ spin of electron $\left(+\frac{1}{2}, -\frac{1}{2}\right)$

2. For n = 4, which one of the following values of *l* is not possible?

Azimuthal quantum number

(A) 1
(B) 2
(C) 3
(D) ~~4~~

For every value of n, l can have values ranging from 0 to n-1

$n = 1, \quad l = 0$

$n = 2, \quad l = 0, 1$

$n = 3, \quad l = 0, 1, 2$

$\boxed{n = 4, \quad l = 0, 1, 2, 3}$

l=0, s subshell
l=1, p "
l=2, d "
l=3, f "

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Δx $\qquad\qquad$ Δp_x

3. If uncertainty in position and momentum are equal, then uncertainty in velocity is:

Δv_x

(A) $\sqrt{\dfrac{h}{\pi}}$ ✗

(B) $\dfrac{1}{2m}\sqrt{\dfrac{h}{\pi}}$ ✓

(C) $\dfrac{h}{2\pi}$ ✗

(D) $\dfrac{1}{m}\sqrt{\dfrac{h}{\pi}}$ ✗

Acc. to uncertainty principle

$$\Delta x \cdot \Delta p_x \geq \frac{h}{4\pi}$$

$$(\Delta x = \Delta p_x)$$

$$\Delta p_x \cdot \Delta p_x \geq \frac{h}{4\pi}$$

$$(\Delta p_x = m \cdot \Delta v_x)$$

$$(m \cdot \Delta v_x)^2 \geq \frac{h}{4\pi}$$

Taking square root both sides

$$m \cdot \Delta v_x \geq \sqrt{\frac{h}{4\pi}}$$

$$\boxed{\Delta v_x \geq \frac{1}{2m}\sqrt{\frac{h}{\pi}}}$$

4. The de-Broglie wavelength associated with a matter particle is :

(A) Directly proportional to the momentum of the particle

(B) Directly proportional to the velocity of the particle

(C) Inversely proportional to the momentum of the particle

(D) Inversely proportional to Planck's constant

m = mass of particle

v = velocity " "

p = momentum " "

$$\lambda = \frac{h}{mv} \Rightarrow \lambda \propto \frac{1}{v} \qquad (mv = p)$$

$$\lambda = \frac{h}{p} \Rightarrow \lambda \propto \frac{1}{p}$$

5. The wavelength (λ) associated with an electron (e^-) moving with velocity (v) $10^{10}\ ms^{-1}$.

(A) 6.62×10^{-10} m

(B) 7.27×10^{-14} m

(C) 3.69×10^{-12} m

(D) 4.92×10^{-11} m

$\lambda = \frac{h}{mv}$

$\lambda = \frac{6.626 \times 10^{-34}}{9.1 \times 10^{-31} \times 10^{10}}$

$\boxed{\lambda = 7.27 \times 10^{-14}\ m}$

h = planck's constant

$h = 6.626 \times 10^{-34}$ Js

($1 J = kg\, m^2 s^{-2}$)

kg → mass

velocity = m/s

mass of e^- = 9.1×10^{-31} Kg

6. **Probability density is given by:**

(A) ψ → wave function → no physical significance.

(B) $[\psi]^2$ → Probability density → gives the probability of finding an electron at a point within an atom

(C) de – Broglie wavelength (λ)

(D) $\hat{H}$ → Hamiltonian operator

m_l

7. The possible values of magnetic quantum number for *p*-orbital are:

(A) 0 ✗
(B) –1, 0, +1
(C) –2, –1, 0, +1, +2 ✗
(D) –3, –2, –1, 0, +1, +2, +3

For p orbital, $l = 1$

for every value of l, possible values of m_l are $-l$ to $+l$ including zero.

$$\boxed{\text{For } l = 1, \quad m_l = -1, 0, +1}$$

8. The notation of orbital with n=5 and *l* =3 is :

(A) 2*p* (B) 5*s*

~~(C)~~ 5*f* (D) 3*d*

$l = 0 \rightarrow s$ subshell

$l = 1 \rightarrow p$ "

$l = 2 \rightarrow d$ "

$l = 3 \rightarrow f$ "

$n = 5 \rightarrow$ shell number.

$l = 3 \rightarrow f$ subshell

notation of orbital = n(subshell)

$= \boxed{5f}$ Ans

smaller $(n+l)$, smaller energy, higher $(n+l)$ value represents higher energy

9. In multi-electron atom 4*s*-orbital is lower in energy than:

~~(A)~~ 3*d*-orbital (B) 3*p*-orbital

(C) 2*s*-orbital (B) 2*p*-orbital

$1s < 2s < 2p < 3s < 3p < 4s < 3d < 4p$

$\boxed{4s, \quad n = 4, \quad l = 0 \rightarrow n + l = 4 + 0 = 4}$

(A) $3d \rightarrow n = 3, \quad l = 2 \rightarrow n + l = 3 + 2 = 5$

(B) $3p \rightarrow n = 3, \quad l = 1 \rightarrow n + l = 3 + 1 = 4$

(C) $2s \rightarrow n = 2, \quad l = 0 \rightarrow n + l = 2 + 0 = 2$

(D) $2p \rightarrow n = 2, \quad l = 1, \quad n + l = 2 + 1 = 3$

→ The orbital having $n+l$ value greater than 4, has higher energy than 4s

If $(n+l)$ value is same, orbital having lower 'n' value will have lower energy; $3p < 4s$

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10. Shape of an orbital is given by

(A) Principal quantum number $(n) \rightarrow$ shell no.

(B) Sin quantum number $(m_s) \rightarrow$ spin of electron $\left(+\frac{1}{2}, -\frac{1}{2}\right)$

(C) Azimuthal quantum number $(l) \rightarrow$ subshell and its shape.

(D) Magnetic quantum number $(m_l) \rightarrow$ orientation of orbitals.

Thank You