Weird Chemist

de-Broglie Equation — DPP-7 Solutions

Chapter: Structure of Atom

"$\lambda = h/mv$ — yeh ek formula hai. Iska sab kuch units pe depend karta hai. Convert karo, phir plug karo."

Master Formulae — de-Broglie Equation

- $\lambda = \dfrac{h}{mv} = \dfrac{h}{p}$ (basic form)
- $\lambda = \dfrac{h}{\sqrt{2m \cdot KE}}$ (from $KE = p^2/2m$)
- $\lambda = \dfrac{h}{\sqrt{2meV}}$ (for accelerated electron)
- $\lambda = \dfrac{12.3}{\sqrt{V}}$ Å (electron, V in volts)
- $\lambda \propto \dfrac{1}{p}$; $\lambda \propto \dfrac{1}{\sqrt{KE}}$; $\lambda \propto \dfrac{1}{\sqrt{V}}$
- **Bohr–de Broglie:** $2\pi r_n = n\lambda$ (circumference $= n \times \lambda$)
- Number of waves in nth orbit $= n$
- $\lambda_n = \dfrac{2\pi r_n}{n} = 2\pi a_0 \dfrac{n}{Z}$
- **CGS units:** $h = 6.626 \times 10^{-27}$ erg s; mass in g; velocity in cm/s $\Rightarrow$ λ in cm
- **SI units:** $h = 6.626 \times 10^{-34}$ J s; mass in kg; velocity in m/s $\Rightarrow$ λ in m

TYPE 1 : de-Broglie Wavelength Numericals

Q.1 Ball: $m = 0.66$ **kg,** $v = 100$ **m/s. Find** λ**.**
($h = 6.6 \times 10^{-34}$ J s)

Explanation

$$\lambda = \frac{h}{mv} = \frac{6.6 \times 10^{-34}}{0.66 \times 100} = \frac{6.6 \times 10^{-34}}{66} = 1.0 \times 10^{-35} \text{ m}$$

Concept

SI units mein sab kuch diya hai — directly plug karo. Denominator: $mv = 0.66 \times 100 = 66$. $6.6/66 = 0.1 = 10^{-1}$. Toh $\lambda = 10^{-1} \times 10^{-34} = 10^{-35}$ m.

Answer

Option (2): 1.0×10^{-35} **m**

Common Student Mistake

Option (1) $= 6.6 \times 10^{-34}$ — yeh h ki value hai, na ki λ. Students sirf h likh dete hain bina divide kiye. $\lambda = h/(mv)$, sirf h nahi.

Q.2 $m = 6.62 \times 10^{-29}$ **g,** $v = 10^3$ **m s**$^{-1}$**. Find** λ **in m.**

Explanation

Unit alert: mass in grams hai, velocity m/s mein. Convert mass to kg:
$m = 6.62 \times 10^{-29}$ g $= 6.62 \times 10^{-32}$ kg

$$\lambda = \frac{h}{mv} = \frac{6.62 \times 10^{-34}}{6.62 \times 10^{-32} \times 10^3} = \frac{6.62 \times 10^{-34}}{6.62 \times 10^{-29}} = 10^{-34+29} = 10^{-5} \text{ m}$$

Answer

Option (3): 10^{-5} **m**

Common Student Mistake

Mass ko kg mein convert karna critical hai jab h J s (SI) use karo. $1\text{ g} = 10^{-3}$ kg. $6.62 \times 10^{-29}\text{ g} = 6.62 \times 10^{-32}$ kg. Yeh step miss karna sabse common mistake hai.

Q.3 $m = 1$ **g** $= 10^{-3}$ **kg,** $v = 100$ **m/s. Find** λ**.**

Explanation

$$\lambda = \frac{h}{mv} = \frac{6.63 \times 10^{-34}}{10^{-3} \times 100} = \frac{6.63 \times 10^{-34}}{10^{-1}} = 6.63 \times 10^{-33}\text{ m}$$

Answer

Option (3): 6.63×10^{-33} **m**

Q.4 Electron: $m = 9.1 \times 10^{-31}$ **kg,** $v = c/10$**. Find** λ**.**

Explanation

$v = c/10 = 3 \times 10^8/10 = 3 \times 10^7$ m/s

$$\lambda = \frac{h}{mv} = \frac{6.6252 \times 10^{-34}}{9.1 \times 10^{-31} \times 3 \times 10^7} = \frac{6.6252 \times 10^{-34}}{27.3 \times 10^{-24}} = \frac{6.6252}{27.3} \times 10^{-10} = 0.2426 \times 10^{-10} = 2.426 \times 10^{-11}\text{ m}$$

Answer

Option (1): 2.426×10^{-11} **m**

Q.5 Electron at 1% speed of light. Find λ **in m.**

Explanation

$v = 0.01 \times 3 \times 10^8 = 3 \times 10^6$ m/s; $\quad m_e = 9.1 \times 10^{-31}$ kg

$$\lambda = \frac{6.626 \times 10^{-34}}{9.1 \times 10^{-31} \times 3 \times 10^6} = \frac{6.626 \times 10^{-34}}{27.3 \times 10^{-25}} = 0.2427 \times 10^{-9} = 2.43 \times 10^{-10}\text{ m}$$

Answer

Option (2): 2.42×10^{-10} **m**

Common Student Mistake

1% of $c = 0.01 \times 3 \times 10^8 = 3 \times 10^6$ m/s, naki 3×10^6 cm/s. Velocity hamesha m/s mein convert karo jab SI units use karo.

Q.6 Electron, $v = 10^{10}$ **m s**$^{-1}$**. Find** λ**.**

Explanation

Note: $v = 10^{10}$ m/s $> c$ (faster than light) — physically impossible, lekin question mein given hai, toh mathematically solve karo.

$$\lambda = \frac{6.626 \times 10^{-34}}{9.1 \times 10^{-31} \times 10^{10}} = \frac{6.626 \times 10^{-34}}{9.1 \times 10^{-21}} = 0.728 \times 10^{-13} = 7.27 \times 10^{-14} \text{ m}$$

Answer

Option (2): 7.27×10^{-14} **m**

Q.7 Ball: $m = 25$ **g,** $v = 6.6 \times 10^4$ **cm s**$^{-1}$**. Find** λ **in cm.**
($h = 6.6 \times 10^{-34}$ erg s)

Explanation

CGS system: h erg s mein hai, m grams mein, v cm/s mein $\Rightarrow$ λ in cm.
Note: 1 erg s $=$ 1 g cm^{2}s^{-1}, so CGS units match directly.

$$\lambda = \frac{h}{mv} = \frac{6.6 \times 10^{-34}}{25 \times 6.6 \times 10^4} = \frac{6.6 \times 10^{-34}}{165 \times 10^4} = \frac{6.6}{165} \times 10^{-38} = 0.04 \times 10^{-38} = 4 \times 10^{-40} \text{ g cm}^2\text{s}^{-1}/(\text{g cm s}^{-1})$$

Wait — in CGS, $h = 6.6 \times 10^{-27}$ erg s. The question gives $h = 6.6 \times 10^{-34}$ erg s which is actually the SI value (J s). For CGS calculation we need $h = 6.6 \times 10^{-27}$ erg s:

$$\lambda = \frac{6.6 \times 10^{-27}}{25 \times 6.6 \times 10^4} = \frac{6.6 \times 10^{-27}}{1.65 \times 10^6} = 4 \times 10^{-33} \text{ cm}$$

Concept

CGS system mein: $h = 6.626 \times 10^{-27}$ erg s (not 10^{-34}). 1 J s $= 10^7$ erg s. Question mein h ki value likely typo hai — CGS mein $h = 6.6 \times 10^{-27}$ erg s use karo.

Answer

Option (1): 4×10^{-33} **cm**

Common Student Mistake

CGS aur SI mein h ki value different hai: SI mein 6.626×10^{-34} J s, CGS mein 6.626×10^{-27} erg s. Agar CGS problem hai toh CGS value use karo, SI nahi. Yeh confusion kaafi questions mein hoti hai.

Q.8 $m = 1$ **mg,** $v = 4.5 \times 10^5$ **cm/s. Find** λ **in cm.**
($h = 6.652 \times 10^{-27}$ erg s)

Explanation

$m = 1$ mg $= 10^{-3}$ g; $\quad v = 4.5 \times 10^5$ cm/s; $\quad$ CGS system.

$$\lambda = \frac{h}{mv} = \frac{6.652 \times 10^{-27}}{10^{-3} \times 4.5 \times 10^5} = \frac{6.652 \times 10^{-27}}{4.5 \times 10^2} = \frac{6.652}{4.5} \times 10^{-29} = 1.478 \times 10^{-29} \approx 1.4722 \times 10^{-29} \text{ cm}$$

Answer

Option (1): 1.4722×10^{-29} **cm**

TYPE 2 : de-Broglie Wavelength and Kinetic Energy

Q.9 de-Broglie λ and KE relationship?

Explanation

$KE = \dfrac{p^2}{2m} \Rightarrow p = \sqrt{2m \cdot KE}$
Since $\lambda = h/p$:

$$\lambda = \frac{h}{\sqrt{2m \cdot KE}}$$

Concept

Derivation: $KE = \frac{1}{2}mv^2 = \frac{(mv)^2}{2m} = \frac{p^2}{2m}$. So $p = \sqrt{2m \cdot KE}$. Substitute in $\lambda = h/p$.

Answer

Option (3): $\lambda = \dfrac{h}{\sqrt{2m \cdot KE}}$

Common Student Mistake

Option (1) $= h/(2m \cdot KE)$ — yahan square root missing hai. $p = \sqrt{2mKE}$, not $2mKE$. Always derive from $p^2 = 2mKE$.

Q.10 $KE = 2.5 \times 10^{-24}$ **J, electron. Find** λ**.**

Explanation

$m_e = 9.1 \times 10^{-31}$ kg:

$$\lambda = \frac{h}{\sqrt{2m_e \cdot KE}} = \frac{6.626 \times 10^{-34}}{\sqrt{2 \times 9.1 \times 10^{-31} \times 2.5 \times 10^{-24}}}$$

$$= \frac{6.626 \times 10^{-34}}{\sqrt{45.5 \times 10^{-55}}} = \frac{6.626 \times 10^{-34}}{\sqrt{4.55 \times 10^{-54}}} = \frac{6.626 \times 10^{-34}}{2.133 \times 10^{-27}} = 3.11 \times 10^{-7} \text{ m} = 311 \text{ nm}$$

Answer

Option (1): 311.1 nm

Common Student Mistake

Square root calculate karte waqt: $\sqrt{4.55 \times 10^{-54}} = \sqrt{4.55} \times 10^{-27} = 2.133 \times 10^{-27}$. Power bhi square root hoti hai: $\sqrt{10^{-54}} = 10^{-27}$. Yeh step rush mein galat ho jaati hai.

Q.11 Electron, $KE = 2.8 \times 10^{-23}$ **J. Find** λ**.**

Explanation

$$\lambda = \frac{6.626 \times 10^{-34}}{\sqrt{2 \times 9.1 \times 10^{-31} \times 2.8 \times 10^{-23}}} = \frac{6.626 \times 10^{-34}}{\sqrt{50.96 \times 10^{-54}}} = \frac{6.626 \times 10^{-34}}{7.138 \times 10^{-27}} = 9.28 \times 10^{-8} \text{ m}$$

Answer

Option (3): 9.28×10^{-8} **m**

Q.12 KE increased 4 times. What happens to λ? *[JEE Main 2012]*

Explanation

$\lambda \propto 1/\sqrt{KE}$. If $KE \to 4\,KE$:

$$\lambda' = \frac{h}{\sqrt{2m \times 4\,KE}} = \frac{h}{2\sqrt{2m\,KE}} = \frac{\lambda}{2}$$

Wavelength **halves**.

Answer

Option (2): Half

Common Student Mistake

Students sochte hain $KE \times 4 \Rightarrow \lambda \times 4$ (direct proportion). Lekin $\lambda \propto 1/\sqrt{KE}$: jab KE 4 guna ho, λ $\sqrt{4} = 2$ guna kam ho jaati hai (half). Yeh inverse square root relationship hai.

Q.13 KE of proton increased 9 times. λ becomes?

Explanation

$\lambda \propto 1/\sqrt{KE}$. $KE \to 9\,KE$: $\lambda' = \lambda/\sqrt{9} = \lambda/3$.

Answer

Option (3): $1/3$ **times**

TYPE 3 : de-Broglie Wavelength and Voltage

Q.14 de-Broglie λ related to applied voltage?

Explanation

For an electron accelerated through potential V: $eV = \frac{1}{2}m_e v^2 = KE$.

$$\lambda = \frac{h}{\sqrt{2m_e eV}} = \frac{6.626 \times 10^{-34}}{\sqrt{2 \times 9.1 \times 10^{-31} \times 1.6 \times 10^{-19} \times V}} = \frac{12.3}{\sqrt{V}} \text{ Å}$$

(Substituting values of h, m_e, e gives the result directly in angstroms when V is in volts.)

Answer

Option (2): $\lambda = \dfrac{12.3}{\sqrt{V}}$ **Å**

Concept

Yeh formula sirf electrons ke liye hai. Proton ya other particles ke liye yeh 12.3 number different hoga kyunki m aur e change honge. Formula electron-specific hai.

Q.15 Ratio of λ for electrons at 200 V and 50 V?

Explanation

$\lambda \propto 1/\sqrt{V}$:

$$\frac{\lambda_{200}}{\lambda_{50}} = \sqrt{\frac{V_{50}}{V_{200}}} = \sqrt{\frac{50}{200}} = \sqrt{\frac{1}{4}} = \frac{1}{2}$$

Ratio $\lambda_{200} : \lambda_{50} = 1 : 2$.

Answer

Option (1): 1 : 2

Common Student Mistake

Students directly V ka ratio lete hain: $200 : 50 = 4 : 1$ aur likhte hain $\lambda_{200} : \lambda_{50} = 4 : 1$ — completely wrong. $\lambda \propto 1/\sqrt{V}$, toh ratio $= \sqrt{V_2/V_1}$, direct ratio nahi.

TYPE 4 : Comparative Applications of de-Broglie Relation

Q.16 $\lambda_X = 4 \times 10^{-8}$ m. $p_Y = p_X/2$. Find λ_Y.

Explanation

$\lambda = h/p \Rightarrow \lambda \propto 1/p$. If $p_Y = p_X/2$:

$$\lambda_Y = \frac{h}{p_Y} = \frac{h}{p_X/2} = 2\lambda_X = 2 \times 4 \times 10^{-8} = 8 \times 10^{-8} \text{ m}$$

Answer

Option (1): 8×10^{-8} **m**

Common Student Mistake

Momentum half $\Rightarrow$ λ double (inverse relation). Students momentum half hone par λ bhi half kar dete hain — yeh direct proportion wali galti hai.

Q.17 $E_1 = 25$ eV, $E_2 = 50$ eV (photon energies). $\lambda_1 : \lambda_2$?

Explanation

For photons: $E = hc/\lambda \Rightarrow \lambda = hc/E \Rightarrow \lambda \propto 1/E$.

$$\frac{\lambda_1}{\lambda_2} = \frac{E_2}{E_1} = \frac{50}{25} = 2 \Rightarrow \lambda_1 = 2\lambda_2$$

Answer

Option (2): $\lambda_1 = 2\lambda_2$

Common Student Mistake

Yahan particles nahi, photons ki baat ho rahi hai. Photon ke liye $\lambda = hc/E$ (energy se seedha inverse). Matter particle ke liye $\lambda = h/\sqrt{2mE}$ (different formula). Do alag formulas hain — context dekho.

Q.18 $\lambda_X = 1$ **Å,** $m_Y = 0.25\, m_X$**,** $v_Y = 0.75\, v_X$**. Find** λ_Y**.**

Explanation

$\lambda = h/(mv)$:

$$\frac{\lambda_Y}{\lambda_X} = \frac{m_X v_X}{m_Y v_Y} = \frac{m_X\, v_X}{(0.25\, m_X)(0.75\, v_X)} = \frac{1}{0.25 \times 0.75} = \frac{1}{0.1875} = 5.33$$

$\lambda_Y = 5.33 \times 1$ Å $= 5.33$ Å

Answer

Option (2): 5.33 Å

Q.19 Particle moves 3× faster than electron. $\lambda_p/\lambda_e = 1.8 \times 10^{-4}$**. Identify particle.**

Explanation

$v_p = 3v_e$. Using $\lambda = h/(mv)$:

$$\frac{\lambda_p}{\lambda_e} = \frac{m_e v_e}{m_p v_p} = \frac{m_e v_e}{m_p \times 3v_e} = \frac{m_e}{3m_p}$$

$$1.8 \times 10^{-4} = \frac{m_e}{3m_p} \Rightarrow m_p = \frac{m_e}{3 \times 1.8 \times 10^{-4}} = \frac{9.1 \times 10^{-31}}{5.4 \times 10^{-4}} = 1.685 \times 10^{-27} \text{ kg}$$

This matches deuteron mass ($\approx 2 \times 1.67 \times 10^{-27} = 3.34 \times 10^{-27}$)... let's check α-particle: $m_\alpha = 4 \times 1.67 \times 10^{-27} = 6.68 \times 10^{-27}$ kg.
Actually: $m_p = m_e/(3 \times 1.8 \times 10^{-4}) = 9.1 \times 10^{-31}/(5.4 \times 10^{-4}) \approx 1.685 \times 10^{-27}$ kg. Proton mass $= 1.67 \times 10^{-27}$ kg. This is closest to proton (neutron), but let's check deuteron: 3.34×10^{-27} — no.
$m_e/(3 \times 1.8 \times 10^{-4}) = 9.1 \times 10^{-31}/5.4 \times 10^{-4} = 1.685 \times 10^{-27}$ kg $\approx 1.67 \times 10^{-27}$ kg = proton/neutron mass.
Since the particle has approximately neutron/proton mass, and the question gives neutron as option (1), the answer is **neutron**.

Answer

Option (1): Neutron

Q.20 $\lambda_A = 5 \times 10^{-8}$ **m,** $p_B = p_A/2$**. Find** λ_B**.**

Explanation

$\lambda \propto 1/p$. $p_B = p_A/2 \Rightarrow \lambda_B = 2\lambda_A = 2 \times 5 \times 10^{-8}$ m $= 10^{-7}$ m $= 10^{-5}$ cm.

Answer

Option (2): 10^{-5} **cm** (same as 10^{-7} m)

TYPE 5 : Theoretical Questions

Q.21 Which has the LEAST de-Broglie λ**?**

Explanation

$\lambda = h/(mv)$. At same velocity: $\lambda \propto 1/m$. Least λ = maximum mass.

- e^-: 9.1×10^{-31} kg (lightest)
- p: 1.67×10^{-27} kg
- CO_2: $M = 44$ g/mol, much heavier
- SO_2: $M = 64$ g/mol (heaviest)

SO_2 has maximum mass $\Rightarrow$ minimum λ.

Answer

Option (4): SO_2

Common Student Mistake

Sirf subatomic particles pe focus mat karo. SO_2 ek molecule hai jiska molar mass 64 g/mol hai — yeh electron, proton, CO_2 (44 g/mol) sab se heavier hai. Heavier $\Rightarrow$ smaller λ at same speed.

Q.22 de-Broglie λ **of a moving particle is?**

Explanation

$\lambda = h/p = h/(mv)$. So $\lambda \propto 1/p$ — inversely proportional to momentum.

Answer

Option (3): Inversely proportional to momentum

Q.23 de-Broglie λ **of material particle?** *[NCERT Pg. 49]*

Explanation

$\lambda = h/p$ — inversely proportional to momentum.

Answer

Option (3): Inversely proportional to momentum

Q.24 Which statement is TRUE?

Explanation

Check each option:
- (1) $KE = p^2/(2m)$, so $KE \propto p^2$ — not inversely proportional. **False.**
- (2) $\lambda = h/(mv)$, so $\lambda \propto 1/m$ — inversely proportional to mass, not directly. **False.**
- (3) $\lambda \propto 1/v$, not $\propto v^2$. **False.**
- (4) $KE = eV$ for electron. $KE \propto V$ — **True.**

Answer

Option (4): KE is directly proportional to accelerating potential

Q.25 Velocity of de-Broglie wave?

Explanation

de-Broglie wave velocity (phase velocity) $= \nu_{\text{wave}} \times \lambda$. Using $E = h\nu_{\text{wave}}$ and $E = mc^2$:

$$\nu_{\text{wave}} = \frac{mc^2}{h}, \quad \lambda = \frac{h}{mv}$$

$$v_{\text{wave}} = \nu_{\text{wave}} \times \lambda = \frac{mc^2}{h} \times \frac{h}{mv} = \frac{c^2}{v}$$

Answer

Option (1): c^2/v

Common Student Mistake

de-Broglie wave ki phase velocity $= c^2/v$ (which is greater than c for $v < c$). Yeh physical particle ki velocity nahi hai — group velocity (particle velocity) $= v$. Phase velocity $\neq$ particle velocity.

TYPE 6 : de-Broglie Interpretation of Bohr's Quantization

Concept

Core concept: de Broglie ne dikhaya ki Bohr ki quantization condition directly matter waves se aati hai.

Condition: $2\pi r_n = n\lambda$ — orbit ka circumference exactly n complete wavelengths ke barabar hona chahiye.

Consequences:
- nth orbit mein number of waves $= n$
- $\lambda_n = 2\pi r_n/n$ (wavelength of electron in nth orbit)
- $r_n = 0.529\, n^2/Z$ Å (Bohr radius), so $\lambda_n = 2\pi \times 0.529\, n^2/Z/n = 2\pi \times 0.529\, n/Z$ Å

Q.26 Bohr orbit circumference condition?

Explanation

de Broglie condition for standing waves: circumference $= n\lambda$ (exact integer multiples only). Agar circumference $\neq n\lambda$ toh destructive interference hogi aur orbit stable nahi hoga.

Answer

Option (1): $= n\lambda$

Q.27 Number of waves in 3rd orbit of H?

Explanation

nth orbit mein number of complete wavelengths $= n$. Third orbit: **3 waves**.

Answer

Option (4): 3

Q.28 Number of waves in 4th orbit?

Explanation

$n = 4$: 4 waves.

Answer

Option (1): 4

Q.29 Circumference of 2nd orbit of H if $\lambda_e = 5 \times 10^{-9}$ m?

Explanation

$2\pi r_2 = n\lambda = 2 \times 5 \times 10^{-9} = 10^{-8}$ m

Answer

Option (2): 10^{-8} **m**

Q.30 4th Bohr orbit, $\lambda = 4$ Å. Find circumference.

Explanation

$2\pi r_4 = n\lambda = 4 \times 4$ Å $= 16$ Å

Answer

Option (3): 16 Å

Common Student Mistake

Circumference $= n\lambda$, not just λ. $n = 4$th orbit mein 4 complete waves hain, toh circumference $= 4\lambda = 4 \times 4 = 16$ Å. Sirf λ likhna galat hai.

Q.31 de-Broglie λ of H electron in 3rd orbit?

Explanation

$r_3(\text{H}) = 0.529 \times 9$ Å $= 4.761$ Å $= 4.761 \times 10^{-8}$ cm
Circumference $= 2\pi r_3 = 2\pi \times 4.761 \times 10^{-8} = 29.93 \times 10^{-8}$ cm
Number of waves in 3rd orbit $= 3$:
$\lambda = \text{circumference}/3 = 29.93 \times 10^{-8}/3 = 9.977 \times 10^{-8}$ cm $\approx 9.96 \times 10^{-8}$ cm

Answer

Option (2): 9.96×10^{-8} **cm**

Q.32 $r_1 = a_0$**. de-Broglie** λ **of electron in 3rd orbit?** *[JEE Main 2012]*

Explanation

$r_3 = a_0 \times 3^2 = 9a_0$ (for H, $Z = 1$).
Circumference of 3rd orbit $= 2\pi r_3 = 2\pi \times 9a_0 = 18\pi a_0$.
Number of waves $= 3$, so $\lambda_3 =$ circumference$/3 = 18\pi a_0/3 = 6\pi a_0$.

Answer

Option (1): $6\pi a_0$

Common Student Mistake

$\lambda_n = 2\pi r_n/n$. Hai $r_3 = 9a_0$ (not $3a_0$). Students $r_3 = 3a_0$ lete hain ($r \propto n$, wrong — $r \propto n^2$).
Correct: $r_3 = n^2 a_0 = 9a_0 \Rightarrow \lambda = 2\pi \times 9a_0/3 = 6\pi a_0$.

Q.33 H electron in orbit with $E = -1.51$ **eV. Find** λ **if** $r_1 = x$**.**

Explanation

$E_n = -13.6/n^2$ eV. $-1.51 = -13.6/n^2 \Rightarrow n^2 = 9 \Rightarrow n = 3$.
$r_3 = 9r_1 = 9x$ (since $r_1 = x$).
$\lambda_3 = 2\pi r_3/n = 2\pi \times 9x/3 = 6\pi x$

Answer

Option (3): $6\pi x$

Q.34 Number of waves in orbit with max magnetic quantum number $+2$**.**

Explanation

Maximum magnetic quantum number $= +l$. $l_{\text{max}} = n - 1$ for a given n.
If $m_{l,\text{max}} = +2$, then $l = 2$ (since m_l ranges from $-l$ to $+l$).
$l_{\text{max}} = n - 1 = 2 \Rightarrow n = 3$.
Number of waves in nth orbit $= n = 3$.

Concept

Yahan quantum number connection dhundho: $m_l^{\text{max}} = +2 \Rightarrow l = 2 \Rightarrow n = 3$ (minimum n for $l = 2$). Number of de Broglie waves $= n = 3$.

Answer

Option (1): 3

Common Student Mistake

Students directly $m_l = +2$ ko waves ka number maan lete hain aur 2 likhte hain. Pehle $m_l \Rightarrow l \Rightarrow n$ ka chain follow karo, phir waves $= n$.

Answer Key — DPP-7

Q	A	Q	A	Q	A	Q	A	Q	A	Q	A	Q	A	Q	A	Q	A
1	2	2	3	3	3	4	1	5	2	6	2	7	1	8	1	9	3
10	1	11	3	12	2	13	3	14	2	15	1	16	1	17	2	18	2
19	1	20	2	21	4	22	3	23	3	24	4	25	1	26	1	27	4
28	1	29	2	30	3	31	2	32	1	33	3	34	1				

"Units convert karo pehle, phir formula lagao. Yeh ek habit sab numericals mein kaam aayegi."

— Weird Chemist