

Q1. JEE Main 2026 (21 January Shift 2)

The energy of an electron in an orbit of the Bohr's atom is $-0.04E_0\text{eV}$ where E_0 is the ground state energy. If L is the angular momentum of the electron in this orbit and h is the Planck's constant, then $\frac{2\pi L}{h}$ is _____ :

- (1) 5 (2) 6 (3) 2 (4) 4

Q2. JEE Main 2026 (23 January Shift 1)

In hydrogen atom spectrum, ($R \rightarrow$ Rydberg's constant) A. the maximum wavelength of the radiation of Lyman series is $\frac{4}{3R}$ B. the Balmer series lies in the visible region of the spectrum C. the minimum wavelength of the radiation of Paschen series is $\frac{9}{R}$ D. the minimum wavelength of Lyman series is $\frac{5}{4R}$ Choose the correct answer from the options given below :

- (1) B, D Only (2) A, B and C Only
(3) A, B and D Only (4) A, B Only

Q3. JEE Main 2026 (22 January Shift 2)

The smallest wavelength of Lyman series is 91 nm. The difference between the largest wavelengths of Paschen and Balmer series is nearly _____ nm .

- (1) 1550 (2) 1217 (3) 1875 (4) 1784

Q4. JEE Main 2026 (21 January Shift 1)

If an alpha particle with energy 7.7 MeV is bombarded on a thin gold foil, the closest distance from nucleus it can reach is _____ m. (Atomic number of gold = 79 and $\frac{1}{4\pi\epsilon_0} = 9 \times 10^9$ in SI units)

- (1) 3.85×10^{-16} (2) 3.85×10^{-14}
(3) 2.95×10^{-16} (4) 2.95×10^{-14}

Q5. JEE Main 2026 (24 January Shift 1)

Two electrons are moving in orbits of two hydrogen like atoms with speeds $3 \times 10^5 \text{ m/s}$ and $2.5 \times 10^5 \text{ m/s}$ respectively. If the radii of these orbits are nearly same then the possible order of energy states are _____ respectively.

- (1) 8 and 10 (2) 9 and 8
(3) 10 and 12 (4) 6 and 5

ANSWERS AND SOLUTIONS

1. (1) 2. (2) 3. (2) 4. (4) 5. (4)

1. (1) In Bohr's atom, the energy levels are $E_n = -\frac{E_0}{n^2}$ where E_0 is the ground state energy.

Given $E = -0.04E_0$, we have $-\frac{E_0}{n^2} = -0.04E_0$, which gives $n^2 = 25$, so $n = 5$.

The angular momentum in Bohr's model is $L = n\hbar = n\frac{h}{2\pi}$.

Therefore, $\frac{2\pi L}{h} = \frac{2\pi}{h} \times n\frac{h}{2\pi} = n = 5$.

2. (2) A. Maximum wavelength of Lyman series ($n = 1$ to $n = 2$):

$$\frac{1}{\lambda} = R \left(1 - \frac{1}{4} \right) = \frac{3R}{4}$$

$$\lambda = \frac{4}{3R} \text{ TRUE}$$

B. The Balmer series lies in the visible region of the spectrum. TRUE

C. Minimum wavelength of Paschen series ($n = 3$ to $n = \infty$):

$$\frac{1}{\lambda'} = R \left(\frac{1}{9} \right)$$

$$\lambda' = \frac{9}{R} \text{ TRUE}$$

D. Minimum wavelength of Lyman series ($n = 1$ to $n = \infty$):

$$\frac{1}{\lambda} = R(1)$$

$$\lambda = \frac{1}{R}, \text{ NOT } \frac{5}{4R} \text{ FALSE}$$

So A, B and C are correct.

3. (2) Smallest wavelength of lyman

$$\frac{1}{\lambda} = R \left(\frac{1}{1^2} - \frac{1}{\infty^2} \right)$$

$$R = \frac{1}{\lambda} = \frac{1}{91} \text{ nm}^{-1}$$

λ_{max} for balmer series

$$n_1 = 2 \rightarrow n_2 = 3$$

$$\frac{1}{\lambda_B} = R \left(\frac{1}{4} - \frac{1}{9} \right)$$

$$\frac{1}{\lambda_B} = \frac{1}{91} \left(\frac{5}{36} \right)$$

$$\lambda_B = \left(\frac{91 \times 36}{5} \right) = 655.2 \text{ nm}$$

λ_{max} paschen

$$n_1 = 3 \rightarrow n_2 = 4$$

$$\frac{1}{\lambda_p} = \frac{1}{91} \left(\frac{1}{3^2} - \frac{1}{4^2} \right) = \frac{1}{91} \times \frac{7}{144}$$

$$\lambda_p = \left(\frac{91 \times 144}{7} \right) = 1872 \text{ nm}$$

$$\Delta\lambda = \lambda_P - \lambda_B = 1872 - 655.2$$

$$\Delta\lambda = 1216.8$$

$$\Delta\lambda \approx 1217$$

4. (4) At closest approach, KE converts to PE:

$$KE = \frac{1}{4\pi\epsilon_0} \times \frac{(2e)(Ze)}{r_{min}}$$

$$r_{min} = \frac{9 \times 10^9 \times 2 \times 79 \times (1.6 \times 10^{-19})^2}{7.7 \times 10^6 \times 1.6 \times 10^{-19}}$$

$$= \frac{9 \times 2 \times 79 \times 1.6 \times 10^{-19}}{7.7} \times 10^3$$

$$= \frac{2275.2}{7.7} \times 10^{-16} = 2.95 \times 10^{-14} \text{ m}$$

5. (4) For hydrogen-like atoms:

$$V \propto \frac{Z}{n} \text{ and } r \propto \frac{n^2}{Z}$$

$$\text{Thus } r \propto \frac{n}{V}$$

Since the radii are nearly the same:

$$\frac{n_1}{V_1} = \frac{n_2}{V_2}$$

$$\frac{n_1}{n_2} = \frac{V_1}{V_2} = \frac{3 \times 10^5}{2.5 \times 10^5} = \frac{6}{5}$$

Possible order of energy states is 6 and 5.