

Chapter 4 Semi Classical Theory and Introduction to Quantum Mechanics

PYQ [IIT-JAM]

Q1. If M_e, M_p and M_H are the rest masses of electron, proton and hydrogen atom in the ground state (with energy -13.6 eV), respectively, which of the following is exactly true? (c is the speed of light in free space)

(a) $M_H = M_p + M_e$

(b) $M_H = M_p + M_e - \frac{13.6 \text{ eV}}{c^2}$

(c) $M_H = M_p + M_e + \frac{13.6 \text{ eV}}{c^2}$

(d) $M_H = M_p + M_e + K$, where $K \neq \pm \frac{13.6 \text{ eV}}{c^2}$ or zero

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Q2. In the hydrogen atom spectrum. the ratio of the longest wavelength in the Lyman series (final state $n = 1$) to that in the Balmer series (final State $n = 2$) is _____

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Q3. Consider Rydberg (hydrogen-like) atoms in a highly excited state with n around 300. The wavelength of radiation coming out of these atoms for transitions to the adjacent states lies in the range:

(a) Gamma rays ($\lambda \sim pm$)

(b) UV ($\lambda \sim nm$)

(c) Infrared ($\lambda \sim \mu m$)

(d) RF ($\lambda \sim m$)

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Q4. Let T_g and T_e be the kinetic energies of the electron in the ground and the third excited states of a hydrogen atom, respectively. According to the Bohr model, the ratio $\frac{T_g}{T_e}$ is

(a) 3

(b) 4

(c) 9

(d) 16

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