

Question 6. Consider a hydrogen atom with its electron in the n th orbital. Electromagnetic radiation of wavelength 90 nm is used to ionize the atom. If the kinetic energy of the ejected electron is 10.4 eV, then the value of n is ($hc = 1242 \text{ eV nm}$).

Given, the wavelength of electromagnetic radiation = 90nm

The energy of the incident photon (E) = $hc / \lambda \Rightarrow hc / 90$

And, the energy of electron on n^{th} orbital for Hydrogen atom = $13.6 / n^2$

So,

The kinetic energy (K E) of ejected electron = (Energy of incident photon)-(Energy of electron on n^{th} orbital for Hydrogen atom)

$$K E = hc / 90 \text{ nm} - 13.6 / n^2 \dots\dots(1)$$

Given, K E = 10.4 eV and $hc = 1242 \text{ eV nm}$

On putting the values in equation (1)

$$10 = 1242 / 90 - 13.6 / n^2$$

$$13.6 / n^2 = 3.8$$

$$n = 2$$