Question 6. Consider a hydrogen atom with its electron in the nth 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 eV nm).

Solution: (2)

Given, the wavelength of electromagnetic radiation = 90nm

The energy of the incident photon (E) = hc / λ ⇒ 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 nm − $13.6 / n^2$ .....(1)

Given, K E = 10.4 eV and hc = 1242 eV nm

On putting the values in equation (1)

10 = 1242 / 90 − $13.6 / n^2$

$13.6 / n^2 = 3.8$

n = 2