Question 5. A hydrogen atom in its ground state is irradiated by the light of wavelength 970 Å. Taking hc/e = 1.237×10^{-6} eV m and the ground state energy of hydrogen atom as -13.6eV the number of lines present in the emission spectrum is.

Solution: (6)

The electron in the ground state of the H-atom jumps to the nth state after absorbing the radiation.

Wavelength of the radiation, λ = 970 Å = 970 × 10^{-10}

Energy gained by the electron, E' =

Thus the energy of the nth state, E_n = −13.6 + 12.75 = −0.85eV

Using: E_n = −13.6 / n^2 eV

∴ -0.85 = −13.6 / n^2

⇒ n = 4

Number of (emission) spectral line, N = n(n − 1) / 2 = 4(4 − 1) / 2 = 6 lines.