

**Question 5. A hydrogen atom in its ground state is irradiated by the light of wavelength 970 Å. Taking  $hc / e = 1.237 \times 10^{-6} \text{ eV m}$  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  $n^{\text{th}}$  state after absorbing the radiation.

Wavelength of the radiation,  $\lambda = 970 \text{ \AA} = 970 \times 10^{-10}$

Energy gained by the electron,  $E' =$

Thus the energy of the  $n^{\text{th}}$  state,  $E_n = -13.6 + 12.75 = -0.85\text{eV}$

Using:  $E_n = -13.6 / n^2 \text{ eV}$

$\therefore -0.85 = -13.6 / n^2$

$\Rightarrow n = 4$

Number of (emission) spectral line,  $N = n(n - 1) / 2 = 4(4 - 1) / 2 = 6 \text{ lines.}$