Q- An electron orbiting a hydrogen atom has an initial energy of -0.544 eV. The atom emits a photon, then absorbs a photon, ending up with an energy of -3.4 eV. What was the wavelength of the emitted photon?

For hydrogen atom energy of the electron in ground state is -13.6 eV and in nth state it is given by

$E_n = -13.6/n^2$

Hence the energies for different higher states are given by

$E_1 = -13.6/1 = -13.6$ eV

$E_2 = -13.6/4 = -3.4$ eV

$E_3 = -13.6/9 = -1.51$ eV

$E_4 = -13.6/16 = -0.85$ eV

$E_5 = -13.6/25 = -0.544$ eV

Thus, we can say that the electron emitting photon while going from state n = 5 to n = 1 and after absorbing photon going from state n = 1 to n = 2.

Hence the wavelength of the emitted photon is given by energy equation

$hc/\lambda = E_5 - E_1$

or $\lambda = 6.63*10^{-34}*3*10^8/[-0.544 -(-3.4)]*1.6*10^{-19}$ m

or $\lambda = 4.35*10^{-7}$ m = 435 nm.

Hence the wavelength of the emitted photon is

λ = 435 nm