Q- The longest wavelength line in the spectrum emitted by an electron trapped in an infinitely deep square well is 610 nm. What is the width of the well?

The wavelength of the light emitted by transition of electron in a square potential well between two energy levels is given by

$$\lambda = \frac{c}{f} = \frac{hc}{\Delta E} \qquad \text{---------- (1)}$$

Here ΔE is the energy difference at the two levels and h is plank's constant.

For the longest wavelength, the difference in energy ΔE should be the minimum and that is between two initial energy levels corresponding to quantum levels 1 and 2. Hence the energy of emitted photon is given by

$$\Delta E = E_2 - E_1 = 4E_1 - E_1 = 3E_1 = 3 * \left(\frac{h^2}{8ml^2}\right)$$

Here *l* is the width of the potential well

Substituting in equation (1) we get

$$\lambda = \frac{hc}{\Delta E}$$

Or $$\lambda = \frac{hc * 8ml^2}{3h^2} = \frac{8ml^2c}{3h}$$

Gives $$l = \sqrt{\frac{3h\lambda}{8mc}} = \sqrt{\frac{3*6.63*10^{-34}*610*10^{-9}}{8*9.11*10^{-31}*3*10^{8}}} = 7.45 * 10^{-10} m$$

Thus the width of the potential well is $7.45*10^{-10}$ m.