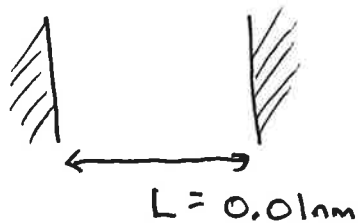


T-L 5-7 (confined proton in 1-D)



a) What are allowed values of λ for the proton confined in this chamber? Need wavefunction to vanish at $x=0$ & $x=L$. If $\psi(x) = \psi_0 \sin(kx)$

The $\psi(x=L) = 0$ only if $kL = n\pi$, $n=1,2,3,\dots$

$$\text{or: } k = \frac{n\pi}{L}$$

$$\text{or: } \frac{2\pi}{\lambda} = \frac{n\pi}{L}$$

$$\text{hence: } \boxed{\lambda_n = \frac{2L}{n}}$$

b) The KE of the proton is

$$KE = \frac{p^2}{2m} = \frac{p_n^2}{2m} = \frac{h^2/\lambda_n^2}{2m}$$

$$E_n = \frac{h^2}{2m} \frac{n^2}{4L^2}$$

$$E_n = \frac{h^2 n^2}{8mL^2}$$

$$E_1 = \boxed{2.05 \text{ eV}} \text{ or } 3.28 \text{ e-19 J}$$

$$E_2 = \boxed{8.19 \text{ eV}} \text{ or } 1.31 \text{ e-18 J}$$