82. (a) The rate at which incident protons arrive at the barrier is $n = 1.0\,\text{kA}/1.60\times10^{-19}\,\text{C} = 6.25\times10^{23}/\text{s}$. Letting $nTt = 1$, we find the waiting time t:

$$\begin{aligned} t &= (nT)^{-1} = \frac{1}{n}\exp\left(2L\sqrt{\frac{8\pi^2 m_p(U-E)}{h^2}}\right) \\ &= \left(\frac{1}{6.25\times10^{23}/\text{s}}\right)\exp\left(\frac{2\pi(0.70\,\text{nm})}{1240\,\text{eV}\cdot\text{nm}}\sqrt{8(938\,\text{MeV})(6.0\,\text{eV}-5.0\,\text{eV})}\right) \\ &= 3.37\times10^{111}\,\text{s} \;\approx\; 10^{104}\ \text{y}\,, \end{aligned}$$

which is much longer than the age of the universe.

(b) Replacing the mass of the proton with that of the electron, we obtain the corresponding waiting time for an electron:

$$\begin{aligned} t &= (nT)^{-1} = \frac{1}{n}\exp\left[2L\sqrt{\frac{8\pi^2 m_e(U-E)}{h^2}}\right] \\ &= \left(\frac{1}{6.25\times10^{23}/\text{s}}\right)\exp\left[\frac{2\pi(0.70\,\text{nm})}{1240\,\text{eV}\cdot\text{nm}}\sqrt{8(0.511\,\text{MeV})(6.0\,\text{eV}-5.0\,\text{eV})}\right] \\ &= 2.1\times10^{-19}\ \text{s}\,. \end{aligned}$$

The enormous difference between the two waiting times is the result of the difference between the masses of the two kinds of particles.