Wednesday, December 09, 2009
10:28 AM

Solution to Quiz 11 (a)

We use eq 41.53 from the book.

$$P_{tunnel} = e^{-2W/\eta}$$

where W is the width of the forbidden region and

$$\eta = \frac{\hbar}{\sqrt{2m(U_0 - E)}}$$

U_0 ——————

E ——————

Here, $W = 15$ fm

Since the electron's energy is 1.5 MeV below the top, we are actually already given

$$U_0 - E = 1.5 \text{ MeV}$$

Plugging values

$$\eta = \frac{\hbar}{\sqrt{2m(U_0 - E)}}$$

$$= 1.05 \times 10^{-34} \text{ J}\cdot\text{s} \Big/ \sqrt{2 \times 1.67 \times 10^{-27} \times 1.5 \times 10^{6} \times 1.6 \times 10^{-19}}$$

$$= 3.70 \times 10^{-15} \text{ m} = 3.70 \text{ fm}$$

$$\Rightarrow P = e^{-(2 \times 15 / 3.70)} = 3.2 \times 10^{-4}$$

$$= 3.2 \times 10^{-4} \times 100 \% = 0.032 \%$$