

# Quiz #4 Solutions (Fall '09)

1)  $\tau_{1/2} = 10^{-25} \text{ s } (= \Delta\tau)$

natural width  
 $\rightarrow \Gamma = \Delta m (= \Delta E)$

$$\Delta E \Delta\tau \geq \hbar/2 \Rightarrow \frac{\Gamma \Delta\tau}{2} = \hbar/2$$

$$\frac{\Gamma}{2} = \frac{\hbar}{2\Delta\tau} = \frac{6.6 \times 10^{-16} \text{ eV} \cdot \text{s}}{2 (10^{-25} \text{ s})}$$

$$\boxed{\Gamma = 6.6 \times 10^9 \text{ eV}}$$

2)  $E_e = 45 \text{ GeV}$

$$\lambda = \frac{h}{p} = \frac{h}{(E/c)} = \frac{hc}{E} = \frac{1239.8 \text{ eV} \cdot \text{nm}}{45 \times 10^9 \text{ eV}}$$

$$\boxed{\lambda = 2.76 \times 10^{-8} \text{ nm}}$$