PHAS3224/2015 : NUMERICAL ANSWERS

Question 7.

(a) The centre-of-mass energy required is $\sim 2 \times m_t = 346$ GeV.

(b) Inserting the given masses yields $E_b = 68$ GeV
Numerically, $\gamma = E/mc^2 \sim 47.6/5 = 9.5$ and :

$$d = 9.5 \times (3.0 \times 10^8) \times (1.5 \times 10^{-12}) = 4.3 \text{ mm}$$

Question 8.

(c) With $\delta E = 1$ eV we have for tritium $(1/(18.6 \times 10^3))^3 \sim 1.6 \times 10^{-13}$.
For rhenium we have $(1/(2.5 \times 10^3))^3 \sim 6.4 \times 10^{-11}$
(The ratio is about 400 although this is not required).

(d) Putting in the numbers (and taking care to convert from $(\text{yr}^{-1}\text{kg}^{-1})$ to $(\text{s}^{-1}\text{mg}^{-1})$ gives an activity of ~ 1 Hz/mg.

Question 9.

(a) Inserting the given values of L and Δm^2 this gives $E = 2.6$ GeV for the first oscillation maximum and 0.8 GeV for the second maximum.

(c) $1 - \frac{m_\mu^2}{m_\pi^2} = 0.43$ and hence $E_\pi = 3.0/0.43 = 7.0$ GeV

Question 10.

(d) $x = 0.0156$.

(e) $x = 0.027$.

(h) $J^P = (5/2)^+$ and $J^P = (3/2)^-$