

Name:

Key

ID#:

1. A beam of muons travels with a speed of $v = 0.6c$. Their mean life-time as observed in the laboratory is found to be 2.9×10^{-6} s. What is the mean life-time of muons when they decay at rest?

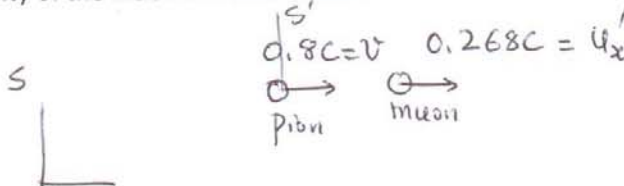
$$\Delta t = \gamma \Delta t'$$

$$2.9 \times 10^{-6} = \frac{1}{\sqrt{1 - (0.6)^2}} \Delta t'$$

$$\Delta t' = 2.9 \times 10^{-6} \times \sqrt{1 - (0.6)^2}$$

$$\boxed{\Delta t' = 2.32 \times 10^{-6} \text{ s}}$$

2. A pion moving along the x-axis with a velocity $0.8c$ in the lab frame decays by emitting a muon with velocity $0.268c$ along the incident direction and in the rest frame of pion. Find the velocity of the muon in the lab frame.



$$u_x = \frac{u'_x + v}{1 + \frac{u'_x v}{c^2}}$$

$$= \frac{0.268c + 0.8c}{1 + \frac{(0.268)(0.8)c^2}{c^2}}$$

$$\boxed{u_x = 0.879c}$$