習題二

1. Textbook Ch. 1 4,5,6,13













1. Consider the decay of a $π^{-} $particle at rest of mass $m\_{π} $into a $μ^{-}$ particle of mass $m\_{μ} $and a massless neutrino$ ν^{0}$, $π^{-}\rightarrow μ^{-}+ν^{0}$. Due to momentum conservation, the magnitude of the $μ^{-}$ momentum $\vec{p} $equals that of $ ν^{0}. $Denote their momentum magnitude as $p.$ Write down the energies $E\_{μ}, E\_{ν} $of $μ^{-}$ and $ ν^{0}$ in terms of $p$. Use energy conservation to solve $p$ in terms of $m\_{π},m\_{μ},c$. (20)

提示：Use the formula we solve in the homework,

$$\frac{E^{2}}{c^{2}}-\left|\vec{p}\right|^{2}=m^{2}c^{2}$$



解答：$E=c\sqrt{\left|\vec{p}\right|^{2}+m^{2}c^{2}}$. $E\_{μ}=c\sqrt{p^{2}+m\_{μ}^{2}c^{2}}$,$E\_{ν}=cp$*.*

Energy conservation: $E\_{π}=E\_{μ}+E\_{ν}. We know E\_{π}=m\_{π}c^{2}.$

$$m\_{π}c^{2}=c\sqrt{p^{2}+m\_{μ}^{2}c^{2}}+cp$$

Move $cp$ to the left and square both sides and $p$ can solved

$$p=\frac{m\_{π}^{2}-m\_{μ}^{2}}{2m\_{μ}}c$$