1. An unstable particle has a rest mass of 1189 Mev/c^2 and a lifetime of 4.0×10^{-16} s in its own rest frame. If it is created in a laboratory bubble chamber, and travels at 98% of the speed of light. Calculate the following with respect to an observer in the laboratory

   (a) The length of the track in the bubble chamber

   (b) its momentum

   (c) its total energy

   (d) its kinetic energy

2. (a) The $^{14}_{6}$ carbon nucleus is radioactive and decays according to

$$^{14}\mathrm{C} \rightarrow ^{14}\mathrm{N} + \beta^- + \bar{\nu}$$

   By considering the mass difference between reactants and products show that the energy released in this disintegrating process is 0.157 MeV. This energy is shared between the ^{14}N, the β^- and the $\bar{\nu}$. The atomic mass of ^{14}C is 14.003242 u and that for ^{14}N is 14.003074 u and the $\bar{\nu}$ has negligible mass.

   (b) If half the energy goes to the β^- find its velocity.