Homework 1 (10 points)

1. Calculaate in Natural Units : 1 kg, 1 s and 1 m expressing them trough GeV.
   What is the distance of 1 Fm in GeV units?

2. (5 points) Consider the reaction $a + b \rightarrow c + d$.
   How many free kinematic parameters this reaction have?

3. Consider the reaction $a + b \rightarrow c + d$ in the center of mass ref. frame. In this frame express the 3 – momenta in the inital and final states of the reaction through the Mandelstam s and masses of the particles.

4. (5 points) Using the results from 3. Calculate E_a, E_b, E_c and E_d. Expressing them again through s and masses.

5. (5) Relate the 3 – momentum of the particle "a" in the Lab frame to the 3 – momentum of the $a + b$ system in the center of mass reff. rframe.

6. (5 points) Show that free electron can not radiate a photon.

7. For ultrarelativistic case express t and u through s and center of mass scattering angle θ_{cm}.