Assignment: Relativity

Due date: Feb- 22

1. The barn paradox: A ladder of proper length 110 m passes through a barn of proper length 100m at a speed 0.6c. What will be the length of the ladder as seen by the farmer in the barn, and the length of the barn as seen by a person attached to the ladder? The farmer shuts and opens the front and rear end of the barn simultaneously for a moment with the ladder inside. The observer attached to the ladder claims this to be false. Explain, with proper space-time diagrams in the two frames, that both the observers are correct.

2. Consider a radioactive nucleus moving with uniform velocity 0.05c relative to the laboratory. The nucleus decays by emitting an elctron with a speed 0.8c along the direction of motion (the common $x - x'$ axis). Find the velocity (magnitude and direction) of the electron in the lab frame, S.

3. A body of mass m at rest breaks up spontaneously into two parts, having rest masses m_1 and m_2 and respective speeds v_1 and v_2. Show that $m > m_1 + m_2$, using conservation of mass-energy.

   ... and the following problems from Kelppner:

   12.1, 12.2, 12.5, 12.13.

   13.4, 13.5, 13.6, 13.7.