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Question 3

This question refers to Unit 12 and carries 30% of the total marks for this assignment.

A subatomic particle in cosmic radiation has a rest mass of 2.40×10^{-30} kg and approaches the Earth's surface vertically at a relative speed of $0.80c$. When it is at 9.0×10^8 m above the surface, it decays into a pair of particles of identical rest mass $m_e = 9.1 \times 10^{-31}$ kg and opposite charge (e^- = electron and e^+ = positron). The electron continues moving in the original direction of the cosmic ray particle.

- (a) Explain the loss of rest-mass in the decay. (5 marks)
- (b) Find the speed of the electron in the rest-frame of the original particle. (10 marks)
- (c) What is the time of flight of the electron (from its creation to reaching the Earth's surface) as measured by a stationary clock on the Earth? (10 marks)
- (d) Calculate the speed of the positron in the frame on the Earth's surface. In what direction, relative to Earth will it travel? (5 marks)

d) $-0.309c$.

c) $-0.954c$

$V_{x'} = -0.652$ $V = -0.8c$