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Special Theory of Relativity
Second Semester
Academic Year: 2012/2013

Assignment 4

Due: Wednesday April 17, 2013

Q1: Show that at low speeds, the relativistic kinetic energy reduces to Newtonian expression.

Q2: Derive the following relation: $K = c\sqrt{m_o^2c^2 + p^2} - m_oc^2$

Q3: Derive the following relation: $p = \dfrac{\sqrt{K^2 + 2m_oc^2K}}{c}$

Q4: Let $\beta = \dfrac{v}{c} = \sin\theta$. Show that: $E = m_oc^2 \sec\theta$

Q5: Let $\beta = \dfrac{v}{c} = \sin\theta$. Show that: $K = m_oc^2 (\sec\theta - 1)$

Q6: Let $\beta = \dfrac{v}{c} = \sin\theta$. Show that: $p^2c^2 = m_o^2c^4(\sec^2\theta - 1)$

Q7: Show that: $K = \left(\dfrac{\gamma^2}{\gamma + 1}\right) m_o v^2 = \dfrac{p^2}{(1+\gamma)\, m_o}$

Q8: An electron has a velocity of 2.4×10^8 m/s. How much energy will it lose in being slowed down to 1.8×10^8 m/s ?

Q9: What is the velocity of a particle whose momentum is m_oc? Express its kinetic energy K and its total energy E in units of m_oc^2.

Q10: A proton (rest mass =940 MeV) has a momentum of 200 MeV/c. Find its kinetic energy.