PHYS 301 Relativistic Energy Name:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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1. The mass of an electron is 9.109 381 88 × 10-31 kg. Calculate the rest energy of the electron in MeV. [c = 2.99792458 x108 m/s, 1eV = 1.60217662 x 10-19 J]

2. The sun radiates electromagnetic energy at the rate of 3.92 times 10 Superscript 26 Baseline  Upper W.

(a)  What is the change in the sun's mass during each second that it is radiating energy?

(b)  The mass of the sun is 1.99 times 10 Superscript 30 Baseline  kg. What fraction of the sun's mass is lost during a human lifetime of 75 years?

3. How much work must be done to increase the speed of an electron from rest to (a) 0.500*c*, (b) 0.990*c*, and (c) 0.9990*c*?

4. To six significant figures, find (a) *γ* and (b) *β* for an electron with kinetic energy *K* = 100.000 MeV.

5. If *m0* is a particle's rest mass, *p* is its momentum magnitude, and *K* is its kinetic energy, (a) show that

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(b) For low particle speeds, show that the right side of the equation reduces to *m*. (c) If a particle has *K* = 55.0 MeV when *p* = 121 MeV/*c*, what is the ratio *m/me* of its mass to the electron mass?

6. The mass of a muon is 207 times the electron mass; the average lifetime of muons at rest is 2.20 *μ*s. In a certain experiment, muons moving through a laboratory are measured to have an average lifetime of 6.90 *μ*s. For the moving muons, what are (a) *β*, (b) *K*, (c) *p* (in MeV/*c*), and (d) *p* in kg.m/s?