Pair Production and Annihilation Questions

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The rest mass of an electron is 9.11×10^{-31} kg. The electron volt (eV) is a unit of energy. $1\,\text{eV} = 1.6 \times 10^{-19}\,\text{J}$

1. What is the rest mass energy of an electron in joules?
2. What is the rest mass energy of an electron in keV?
3. Draw a diagram showing how an electron–positron pair can be produced in the process of pair production.
4. What is the minimum energy photon that can produce a positron–electron pair?
5. What is the minimum photon frequency required for pair production of an e^- e^+ to take place?
6. What is the maximum wavelength photon required for pair production of an e^- e^+ to take place?
7. To which part of the electromagnetic spectrum does this correspond?
8. If e^- e^+ annihilate, what energy photons are emitted?

A muon, (symbol μ^-), has a rest mass about 207 times greater than the rest mass of an electron.

1. What is the rest mass energy of a muon in joules?
2. What is the rest mass energy of a muon in MeV?
3. Draw a diagram showing how a muon and anti-muon pair can be produced in the process of pair production.
4. What is the minimum energy photon that can produce a muon and anti-muon pair?
5. What is the minimum photon frequency required for pair production of μ^- μ^+ to take place?
6. What is the maximum wavelength photon required for pair production of μ^- μ^+ to take place?
7. If μ^- μ^+ annihilate, what energy photons are emitted?