1. ANNIHILATION (6 points) *(by L. Franti)* An electron with kinetic energy 1 MeV travels along the z-axis and collides with a positron at rest. The particles annihilate producing a pair of two photons A and B with equal energies.

i) *(1.5 points)* Find the speed of the electron v_e in the lab frame.

ii) *(0.5 points)* Find the energy E_γ of photon A in the lab frame.

iii) *(1 point)* Find the momentum p_γ of photon A in the lab frame.

iv) *(2 points)* Find the angle α between the z-axis and the momentum of photon A in the lab frame.

v) *(1 point)* Why is it not possible for a collision process to produce just one single photon?

The rest mass of electron $m_e = 511\,\mathrm{keV}/c^2$. You can express your results in electron volts and related units.