2-5) Two 1-kg masses are separated by a spring of negligible mass. They are pushed together, compressing the spring. If the work done in compressing the spring is 10 J, find the change in mass of the system in kilograms. Does the mass increase or decrease?

2-23) The K^0 particle decays according to the equation K^0 → π^+ + π^-. If a particular K^0 decays while it is at rest in the laboratory, what are the kinetic energies of each of the two pions? (The rest mass of the K^0 is 497.7 MeV/c^2)

2-35) A synchronous satellite “parked” in orbit over the equator is used to relay microwave transmissions between stations on the ground. To what frequency must the satellite’s receiver be tuned if the frequency of the transmission from Earth is exactly 9.375 GHz? (Ignore all Doppler effects.)

2-44) Show that the creation of an electron-position pair (or any particle-antiparticle pair, for that matter) by a single photon is not possible in isolation, i.e., that additional mass (or radiation) must be present. (Hint: Use the conservation laws.)

2-49) A pion spontaneously decays into a muon and an antineutrino according to \( \pi^- \rightarrow \mu^- + \bar{\nu}_\mu \). Current experimental evidence indicates that the mass \( m \) of the \( \bar{\nu}_\mu \) is no greater than about 190 keV and may, in fact, be zero. Assuming that the pion decays at rest in the laboratory, compute the energies and momenta of the muon and muon antineutrino (a) if the mass of the antineutrino is zero and (b) if its mass is 190 keV. The mass of the pion is 139.56755 MeV/c^2 and the mass of the muon is 105.65839 MeV/c^2.