ASTR 680 Practice questions for lecture 23: Ultra High Energy Cosmic Rays

1. Look up some of the ways that researchers hope to figure out the composition of UHECRs. That is, what are the differences between (say) a single proton at 10^{20} eV and an iron nucleus of that total energy?

2. Calculate the expected energy of the GZK cutoff (recall that it comes from photopion production off of the cosmic microwave background). If the initial energy of the cosmic ray was even higher (say, 10^{21} eV to 10^{23} eV), how much would the mean free path in the intergalactic medium be changed?