37. (a) Since the mass of an electron is $m = 9.109 \times 10^{-31}$ kg, its Compton wavelength is

$$\lambda_C = \frac{h}{mc} = \frac{6.626 \times 10^{-34}\,\mathrm{J \cdot s}}{(9.109 \times 10^{-31}\,\mathrm{kg})(2.998 \times 10^{8}\,\mathrm{m/s})} = 2.426 \times 10^{-12}\,\mathrm{m} = 2.43\ \mathrm{pm}\ .$$

(b) Since the mass of a proton is $m = 1.673 \times 10^{-27}$ kg, its Compton wavelength is

$$\lambda_C = \frac{6.626 \times 10^{-34}\,\mathrm{J \cdot s}}{(1.673 \times 10^{-27}\,\mathrm{kg})(2.998 \times 10^{8}\,\mathrm{m/s})} = 1.321 \times 10^{-15}\,\mathrm{m} = 1.32\ \mathrm{fm}\ .$$

(c) We use the formula developed in Exercise 3: $E = (1240\,\mathrm{eV \cdot nm})/\lambda$, where E is the energy and λ is the wavelength. Thus for the electron, $E = (1240\,\mathrm{eV \cdot nm})/(2.426 \times 10^{-3}\,\mathrm{nm}) = 5.11 \times 10^{5}\,\mathrm{eV} = 0.511\,\mathrm{MeV}$.

(d) For the proton, $E = (1240\,\mathrm{eV \cdot nm})/(1.321 \times 10^{-6}\,\mathrm{nm}) = 9.39 \times 10^{8}\,\mathrm{eV} = 939\,\mathrm{MeV}$.