(5.2) Using a magnetic spectrometer the maximum energy of the electrons from ^{137}Cs was found in Figure 5.1 to correspond to 3.15×10^{-3} Tesla m. Calculate the energy:

(a) assuming the electrons are non-relativistic.

Given are:

$eV := 1.6021773 \cdot 10^{-19} \cdot joule$ $\qquad MeV := 10^{6} \cdot eV$

$Br := 3.15 \cdot 10^{-3} \cdot tesla \cdot m$ $\qquad q_e := 1.6021773 \cdot 10^{-19} \cdot coul$ $\qquad m_e := 9.109390 \cdot 10^{-31} \cdot kg$

$$E_{nr} := \frac{(q_e \cdot Br)^2}{2 \cdot m_e}$$ Eqn. (3.12)

$E_{nr} = 1.398 \cdot 10^{-13} \cdot joule$ $\qquad E_{nr} = 0.873 \cdot MeV$ $\qquad E_{nr} = 0.87 \cdot MeV$ rounded value

(b) with correction for relativistic mass increase

$c_{light} := 299792458 \cdot m \cdot sec^{-1}$ $\qquad E_{rel} := 1.4 \cdot 10^{-12} \cdot joule$

Given

$$E_{rel} - \frac{q_e^2 \cdot Br^2}{2 \cdot \left(m_e + \frac{E_{rel}}{c_{light}^2}\right)} = 0 \cdot joule$$

Eqn. (3.12) combined with eqn. (2.9).
Use this form to locate zero.

$E_{relf} := Find(E_{rel})$ This formula locates the first zero and the correponding value of E_{rel}.

$E_{relf} = 0.459 \cdot MeV$ $\qquad E_{relf} = 0.46 \cdot MeV$ rounded value