(3.4) A Nier type mass spectrometer has a fixed radius of curvature of 5 cm and a magnetic field of 3000 G; 1 G = 0.0001 T. At what accelerating voltage will a Na^+ ion be brought to focus on the ion collector?
N.B. Na is an element with a single stable isotope, ^{23}Na.

First we must define the value of an atomic mass unit, u, and the elementary charge, q_e, as follows:

$u := 1.660540 \cdot 10^{-27} \cdot kg$ $\qquad$ $q_e := 1.6021773 \cdot 10^{-19} \cdot coul$

Then we introduce the atomic weight of ^{23}Na, Mw_{Na}, and the charge of the sodium ion, q_{Na}:

$Mw_{Na} := 22.99$ $\qquad$ $q_{Na} := 1 \cdot q_e$

Now we can calculate the mass of a single ^{23}Na ion (in kg):

$m_{Na} := Mw_{Na} \cdot u$ $\qquad$ $m_{Na} = 3.818 \cdot 10^{-26} \cdot kg$

The magnetic field, B, and the radius, r, of the spectrometer are given as:

$B := 3000 \cdot 0.0001 \cdot tesla$ $\qquad$ $r := \frac{5}{100} \cdot m$

We can rearrange eqn. (3.12) in order to calculate the acceleration potential, V_{acc}:

$V_{acc} := q_{Na} \cdot r^2 \cdot \frac{B^2}{2 \cdot m_{Na}}$ $\qquad$ $V_{acc} = 472.144 \cdot kg \cdot m^2 \cdot sec^{-2} \cdot coul^{-1}$

or in standard electrical units:

$V_{acc} = 472 \cdot volt$