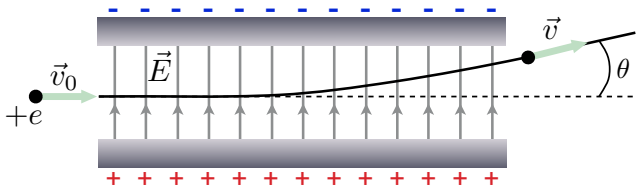
Name: _____

UNIVERSITY OF ALABAMA
Department of Physics and Astronomy

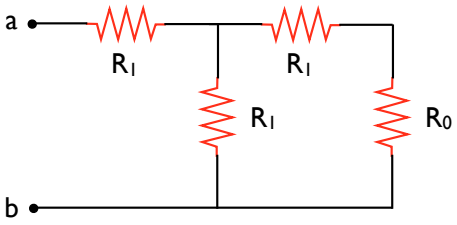
PH 106-4 / LeClair Fall 2008

Random Exercises

1. 10 points. An ion milling machine uses a beam of gallium ions ($m = 70\,\text{u}$) to carve microstructures from a target. A region of uniform electric field between parallel sheets of charge is used for precise control of the beam direction. Single ionized gallium atoms with initially horizontal velocity of 1.8×10^4 m/s enter a 2.0 cm-long region of uniform electric field which points vertically upward, as shown below. The ions are redirected by the field, and exit the region at the angle θ shown. If the field is set to a value of $E = 90$ N/C, what is the exit angle θ?



2. 15 points. In the circuit below, if R_0 is given, what value must the R_1 have for the equivalent resistance between the two terminals a and b to be R_0?



3. 10 points. You are given two batteries, one of 9 V and internal resistance $0.50\,\Omega$, and another of 3 V and internal resistance $0.40\,\Omega$. How must these batteries be connected to give the largest possible current through an external $0.30\,\Omega$ resistor? What is this current?