PHYS UN1602 Recitation Week 6 Worksheet

TA: Nitya Nigam

March 5-6, 2025

Problem 1

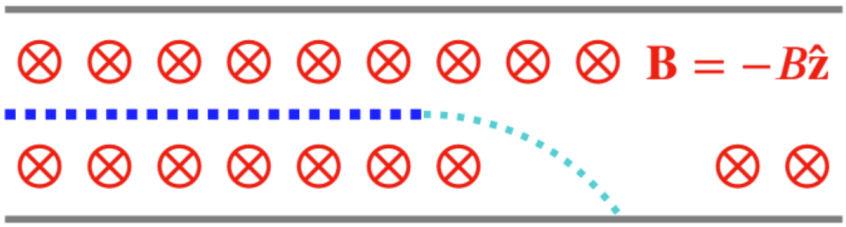
A tetrahedron has equal resistors R along each of its six edges. Find the equivalent resistance between any two vertices. Do this by:

a) using the symmetry of the tetrahedron to reduce it to an equivalent resistor;

b) laying the tetrahedron flat on a table, hooking up a battery with an emf $\mathcal{E}$ to two vertices, and writing down the four loop equations.

Problem 2

Consider a parallel plate capacitor of distance d with a beam of electrons each with velocity v travelling through the capacitor arrangement and a magnetic field, B, coming into the page, as shown below, where the smaller dotted line shows where the electrons initially go in the presence of the magnetic field. You can assume that the charge carrier density is n and the drift velocity is the same as our velocity v.



a) Compute the magnetic force (including its direction) on the beam of charges.

b) Eventually, enough negative charges will gather upon the plate to produce a uniform electric field, imparting an opposing force on the electron beam realigning it into a straight path. What is that electric field?

c) Given that the electric field is constant, what is the potential difference?

d) Write the potential difference as a product involving the current. What is the expression for the current of charges? The remaining term is called the *Hall resistance*. What is the Hall resistance?