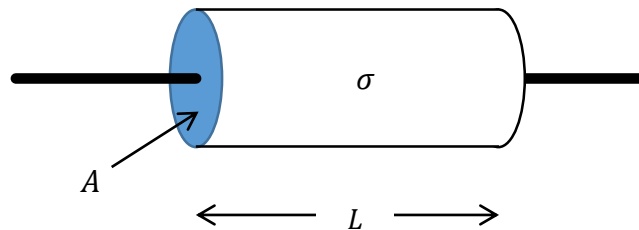


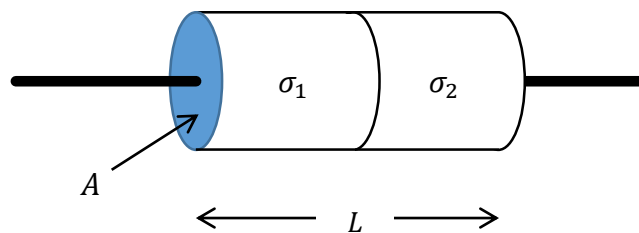
Physics 53600 – Assignment #1 – Due January 28, 2020

1. A resistor is made from a homogeneous material with conductivity σ and has length L and cross sectional area A as shown:



If there is a potential difference ΔV across the ends of the resistor,

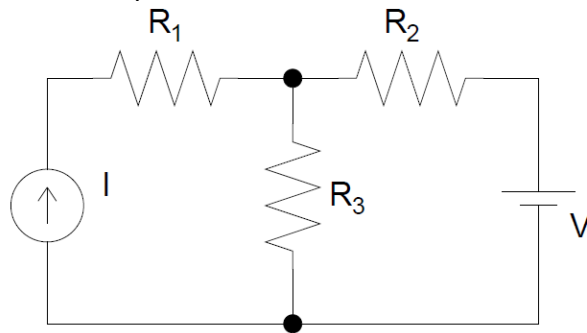
- Solve Poisson's equation to show that the electric field is constant inside the material.
 - What is the current density inside the material?
 - What is the charge density inside the material?
2. A resistor is constructed from two types of material with conductivities σ_1 and σ_2 as shown, each of which has length $L/2$.



If there is a potential difference ΔV across the ends of the resistor,

- What is the electric field in each part of the resistor?
- What is the current density in each part of the resistor?
- What is the charge density at the interface between the two materials?

3. The following two-loop circuit has a constant current source across which an unknown potential difference ΔV will be produced:



This circuit can still be analyzed as a linear 2×2 system of equations, which must be solved to determine the unknown ΔV and the current, I_2 , that flows in the second loop, which includes the voltage source.

- (a) Write down the 2×2 system of linear equations in the unknowns ΔV and I_2 .
- (b) Use Kramer's rule to solve for the potential difference across the current source, ΔV .
- (c) Use Kramer's rule to solve for the current, I_2 , flowing in the second loop.