Massachusetts Institute of Technology
Department of Physics
Physics 8.022 - Fall 2002

Assignment #5
Current, Resistance, Ohm's Law
EMF, Circuits, Kirchhoff's Rules, RC Circuits

Reading *Purcell* Chapter 4.

Problem Set #5
Work on **all** problems. Not all problems receive equal points. Total points for this set is 100.

- **(20 points) [1]** Current Flow Between Cylindrical Plates.

  The space in between two cylindrical copper plates of radius a and b ($b>a$)i s filled with a material of conductivity σ. The length of the plates is L. The two plates are kept at constant potential V_a and V_b ($V_a>V_b$). Express all your answers in terms of V_a,V_b,a,b and L.
  - Find the resistance of this configuration.
  - Find the current density $\vec{J}$ in the space between the two cylinders.
  - Find the electric field $\vec{E}$ in the space between the two cylinders.

- **(20 points) [2]** Snell's Law for Electric Currents.

  An infinite medium has two regions I and II each with conductivity σ_1 and σ_2 separated by a plane interface. In region I a uniform current density $\vec{J}_1$ flows up to the interface at an angle θ_1.

  - Find the magnitude and angle of the current density $\vec{J}_2$ in region II.
  - Find the charge denisty σ on the interface.

- **(15 points) [3]** *Purcell* Problem 4.21 (p.165): Resistive Network.

- **(15 points) [4]** *Purcell* Problem 4.25 (p.165): Discharging Capacitor.

- **(15 points) [5]** *Purcell* Problem 4.32 (p.168): Infinite Resistor Chain..

- **(15 points) [6]** *Purcell* Problem 4.33 (p.168): Kirchhoff's Law and Minimum Power Requirement.

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