

# PHYS 2102

Exam 2

Fall 2003

Dr. Aktas

Name : \_\_\_\_\_

SS # : \_\_\_\_\_

You have five questions, 20 points each.

This is a closed book exam. I understand I am not to use any notes or information other than on this exam sheet. I may use a pocket calculator but only for the purpose of numerical calculation. I accept the responsibility to know and observe the requirements of the UNC-Charlotte Code of Student Academic Integrity.

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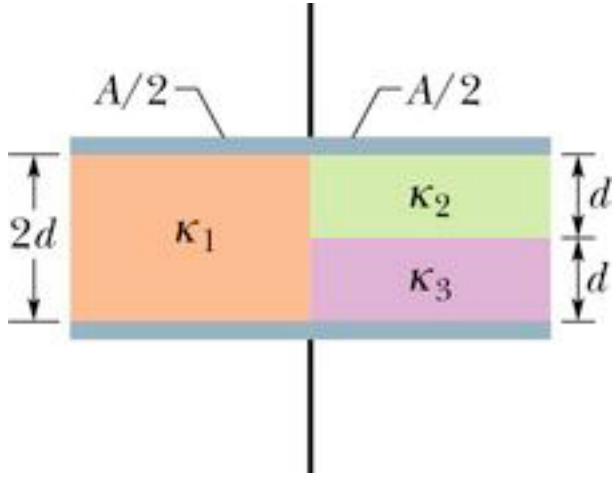
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Signature

*Good luck*

Show all of your work. Do not skip steps. First write down the relevant equations then substitute the numbers if necessary.

1. What is the capacitance of the capacitor, of plate area  $A$ , shown in figure below?

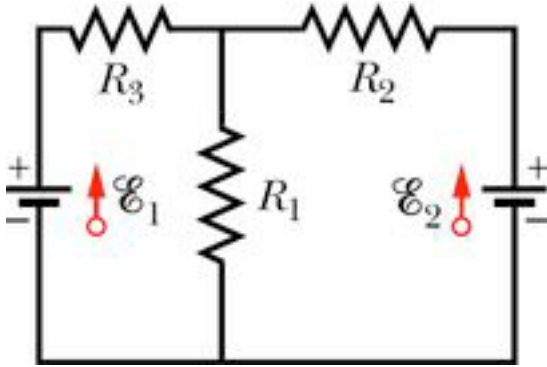


2. The current density across a cylindrical conductor of radius  $R$  varies in magnitude according to the equation

$$J = J_0 \left(1 - \frac{r}{R}\right),$$

where  $r$  is the distance from the central axis. Thus, the current density is a maximum  $J_0$  at that axis ( $r = 0$ ) and decreases linearly to zero at the surface ( $r = R$ ). Calculate the current in terms of  $J_0$  and the conductor's cross-sectional area  $A = \pi R^2$

3. In figure below ,  $\epsilon_1 = 3.00 \text{ V}$ ,  $\epsilon_2 = 1.00 \text{ V}$ ,  $R_1 = 5.00 \text{ }\Omega$ ,  $R_2 = 2.00 \text{ }\Omega$ ,  $R_3 = 4.00 \text{ }\Omega$ , and both batteries are ideal. What is the rate at which energy is dissipated in (a)  $R_1$ , (b)  $R_2$ , and (c)  $R_3$ ? What is the power of (d) battery 1 and (e) battery 2?



4. A capacitor with initial charge  $q_0$  is discharged through a resistor. In terms of the time constant  $\tau$ , how long is required for the capacitor to lose (a) the first one-third of its charge and (b) two-thirds of its charge?

5. A certain wire has a resistance  $R$ . What is the resistance of a second wire, made of the same material, that is half as long and has half the diameter?

