Topics 4-9 Study Guide

I. Things to memorize. The first question on the test will be a blank space where you will be asked to reproduce the following information from memory.

A. Units:

Quantity	SI Unit
electric charge (q)	Coulombs (C)
electric field (E)	Newtons/Coulomb (N/C)
electric potential (V)	Volts (V) or N·m/C
electric flux (Φ_E)	V·m
electric current (I)	Amp (A) or C/s
capacitance (C)	Farad (F) or C/V
resistance (R)	Ohm (Ω)

B. Equations for electrostatics

- Coulomb's Law: $F = k\frac{q_1 q_2}{r^2}$
- Electric field from point charge: $E = k\frac{q}{r^2}$
- Electric potential from point charge: $V = k\frac{q}{r}$
- Electric potential energy: $\Delta U = q\Delta V$
- Electric flux: $\Phi_E = \int \vec{E} \cdot d\vec{A}$
- Gauss's Law: $\oint \vec{E} \cdot d\vec{A} = q_{enc}/\varepsilon_0$

C. Equations for capacitance

- $Q = CV$
- $C_{equivalent}^{series} = \left(\frac{1}{C_1} + \frac{1}{C_2}\right)^{-1}$
- $C_{equivalent}^{parallel} = C_1 + C_2$
- $PE_C = \frac{1}{2}CV^2$

D. Equations for resistance

- $V = IR$
- $R_{equivalent}^{series} = R_1 + R_2$
- $R_{equivalent}^{parallel} = \left(\frac{1}{R_1} + \frac{1}{R_2}\right)^{-1}$
- $P = IV$

II. Proofs.

- Be able to integrate over a given continuous charge distribution to derive an expression for the electric field or electric potential at a given point.
- Be able to use Gauss's Law to obtain electric flux through a given surface.

III. Problem solving.

There will be 1 or 2 questions directly from the HW and 1 or 2 original questions. Topics will include electrostatics and capacitor/resistor/battery circuits (including Kirchoff's laws).