PHYS 5C:

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current $I = \frac{\mathrm{dq}}{\mathrm{dt}}$

Ohms law: $J = \sigma E \qquad V = \mathrm{IR} \qquad \frac{\mathrm{du}}{\mathrm{dt}} = \frac{\mathrm{dq}}{\mathrm{dt}} V$

I. Electrostatis

- (power) $\frac{\mathrm{du}}{\mathrm{dt}} = \frac{\mathrm{dq}}{\mathrm{dt}} V = \mathrm{IV}$
- $P = \mathrm{IV} = \frac{\mathrm{joules}}{\mathrm{sec}} = \mathrm{watt}$

  $\mathrm{IV} = I(\mathrm{IR}) = I^2 R \qquad \mathrm{OR} \frac{V^2}{R}$

II. DC Circuits

- $I_1 = I_2 = I$ Charge capacitors

  $V = V_1 + V_2 \Rightarrow (\mathrm{IR}_1 + \mathrm{IR}_2) = I(R_1 + R_2) = \mathrm{IR}$

III. Real Batteries

- Series: $V_0 = I(R_{\mathrm{int}} + R_{\mathrm{ext}})$
- $V_{\mathrm{ext}} = I(R_{\mathrm{ext}}) \Rightarrow \frac{R_{\mathrm{ext}}}{(R_{\mathrm{int}} + R_{\mathrm{ext}})} V_0$

IV. FOrmalize circuit analysis

- Kirchoff Rules:

  1. $I_1 = I_2 + I_3$
  2. Energy cons: sum of changes in potential around any clouse loop is 0