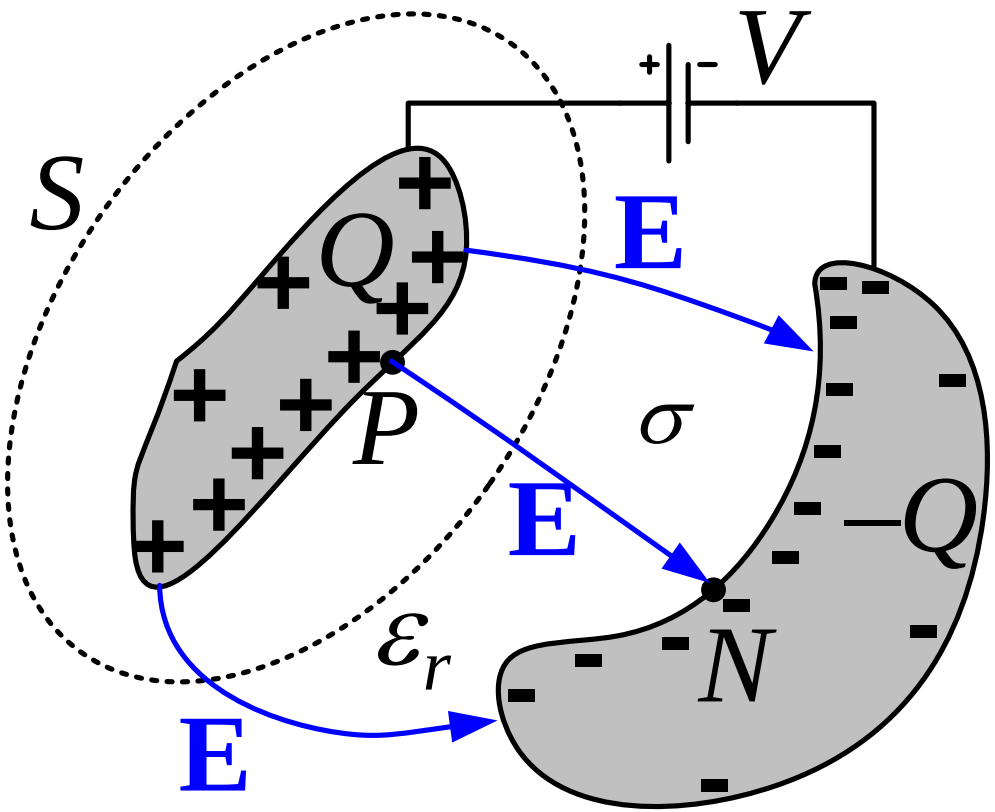
# Lecture 16: Electrostatics

Resistance and Capacitance, Chapter 6, pages 239-256

# Two Conductors



# Evaluating Resistance between Two Conductor

start with Poisson's or Laplace's equations to determine $V(\boldsymbol{r})$

evaluate electric field using $\mathbf{E} = -\nabla V$

evaluate current density using $\mathbf{J}=\sigma\mathbf{E}$

evaluate current flowing between the two conductors using

$$I = \oiint_S \mathbf{J}.\mathrm{d}\,\mathbf{S}$$

conductance is given by $G = \dfrac{I}{V_a - V_b}$

# Evaluating Capacitance (V-method)

start with Poisson's or Laplace's equations to determine $V(\boldsymbol{r})$

evaluate electric field using $\mathbf{E} = -\nabla V$

evaluate **D** using $\mathbf{D}=\varepsilon\mathbf{E}$

evaluate electric flux diverging from the positive conductor using

$$Q = \psi = \oiint \mathbf{D}.\mathrm{d}\,\mathbf{S}$$

capacitance is given by $C = \dfrac{Q}{V_a - V_b}$

# Evaluating Capacitance (Q-method)

start by assuming a charge $Q$ on one of the positive conductor

apply Gauss Law to solve for **D**

evaluate **E** using $\mathbf{E}=\mathbf{D}/\varepsilon$

evaluate potential difference between the two conductors using

$$V_a - V_b = \int_a^b \mathbf{E}.\mathrm{d}\,\mathbf{L}$$

capacitance is given by $C = \dfrac{Q}{V_a - V_b}$