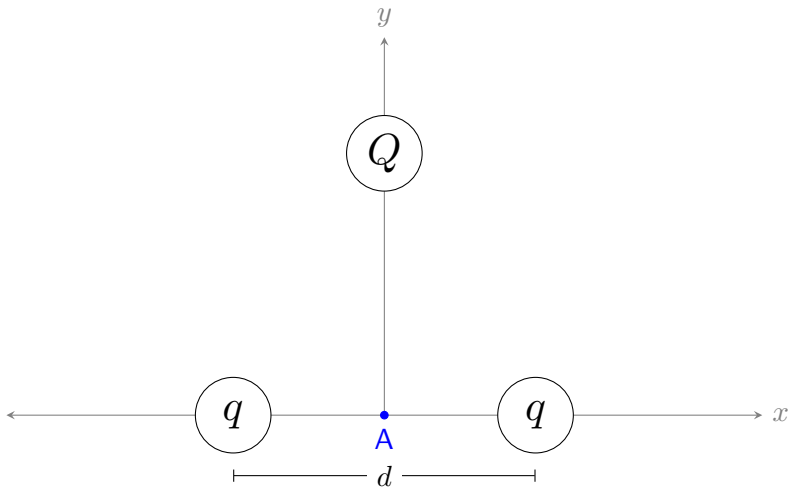
Physics 114 Practice Problems for Exam 2

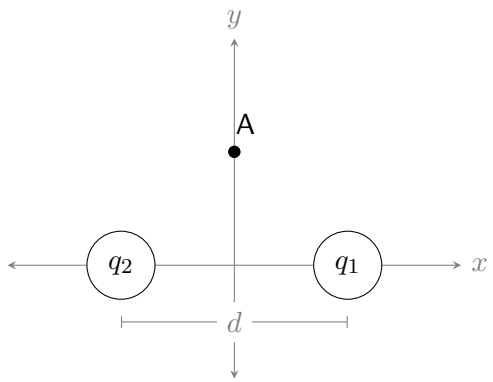
October 29, 2026

1. Three point charges, two of charge q and one of charge Q, are arranged in a fixed equilateral triangle with side length d, as shown in the diagram below.



The two charges q are first fixed before the charge Q is brought in from infinity. Compute the work W an external force exerts on the charge Q in order to bring it from infinity to its fixed place in the above triangle.

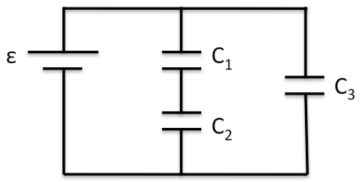
2. Two point charges $q_1 = +Q$ and $q_2 = -2Q$ are separated by a distance d apart, centered about the origin. Point A $(0, a)$ sits on the y-axis midway between them, as in the diagram.



Take the electric potential to be zero at infinity. Find the potential at point A in terms of the variables given and any fundamental constants.

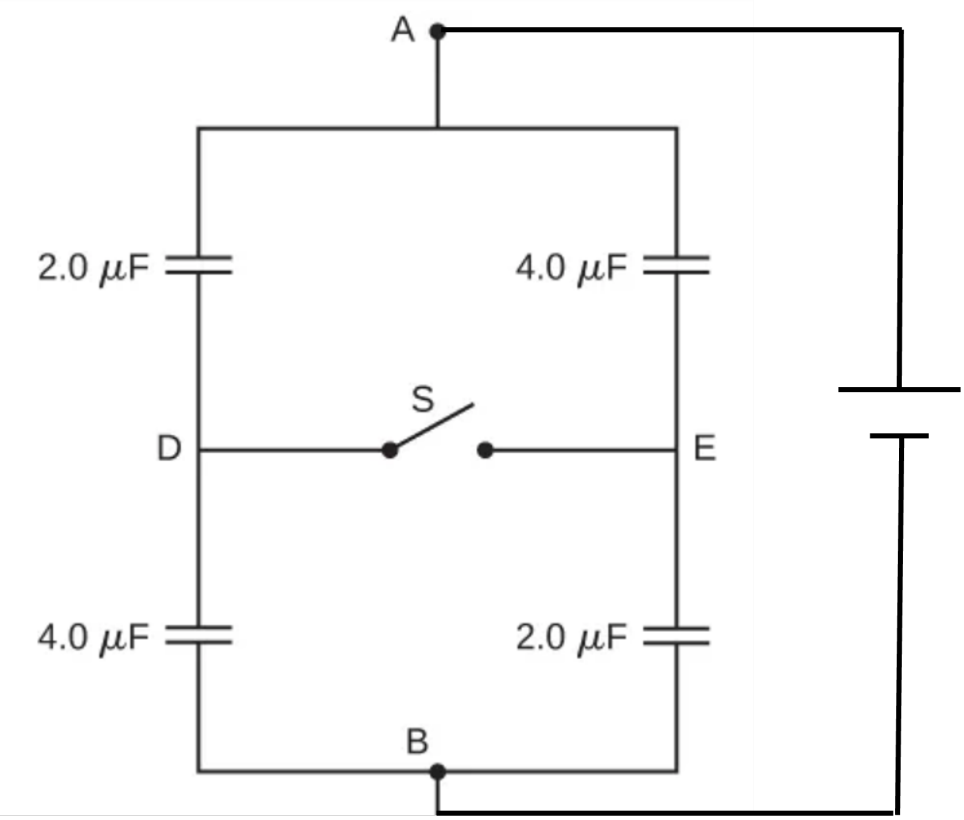
3. An electron travels in from infinity, initially traveling to the right at a speed v. It eventually encounters four more stationary electrons arranged in a square with side length d, as shown in the figure below. If the electron happens to stop directly in the center of this square, then what is the side length d?





4. Three identical capacitors, each with capacitance C, are connected to a battery as shown, and left for a long time (until equilibrium is reached).

   What is the charge on each individual capacitor C_1, C_2, and C_3?

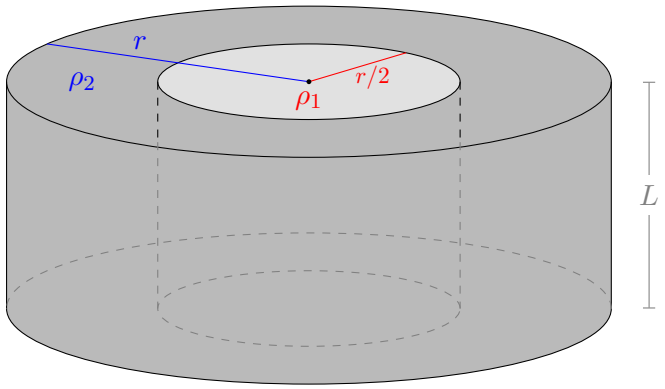


5. The network of capacitors shown below are all uncharged when a 300-V voltage source is connected between points A and B as shown, with the switch S open.

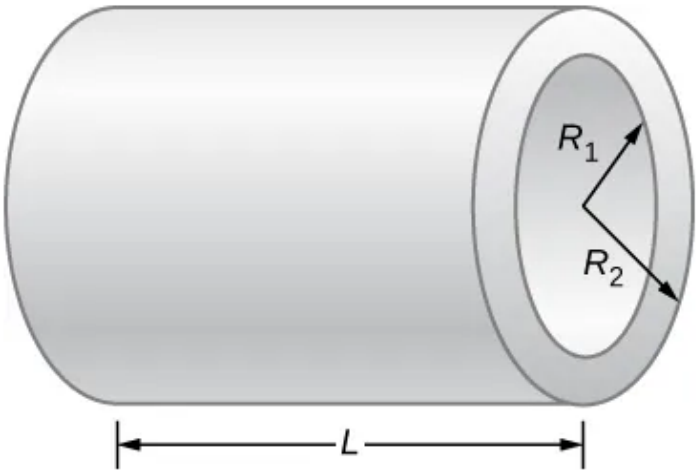
   (a) What is the potential difference $V_E - V_D$ after equilibrium is reached?

   (b) Now the switch S is closed. What is the potential at point E after equilibrium is reached?

6. A cylindrical resistor of total radius r and length L is constructed out of two different metals. The inner part of the resistor consists of a solid cylinder of radius $r/2$ and length L made of one metal with resistivity ρ_1. Then, this core is surrounded by another cylindrical shell between radius $r/2$ and radius r made of a second metal with resistivity ρ_2; see the diagram below.



Compute the resistance R of this bimetallic cylindrical resistor. Check that the special case $\rho_2 = \rho_1$ reduces to the expected result. [Hint: Think about whether the two metals are connected in series or parallel.]



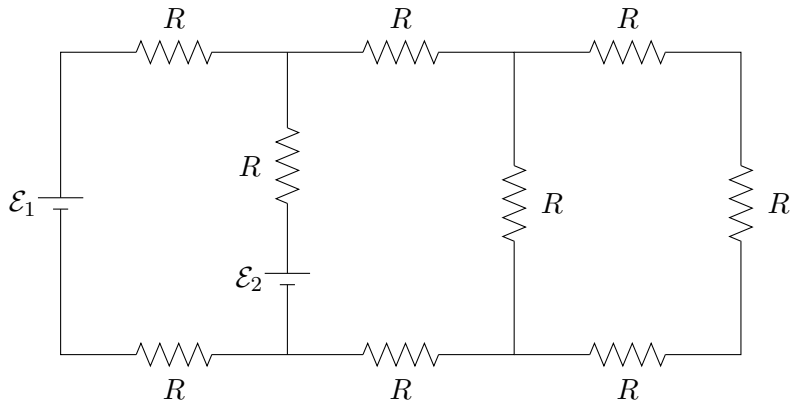
7. Consider a resistor made from a hollow cylinder of carbon as shown below. The inner radius of the cylinder is $R_1 = 2.0$ mm and the outer radius is $R_2 = 2.1$ mm. The length of the resistor is $L = 10.0$ mm. The resistivity of the carbon is $\rho = 3.5 \times 10^{-5}$ Ωm.

   (a) What is the end-to-end resistance?

   (b) If 5 Volts were applied across the resistor, how much current would flow through it?

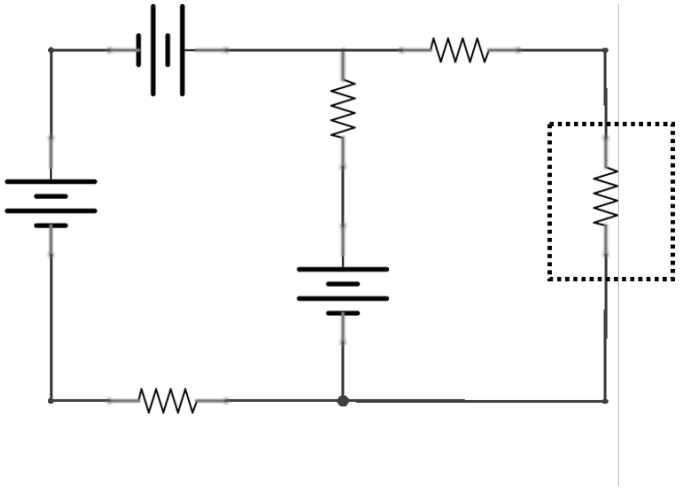
   (c) How much power would be dissipated in the resistor in this case?

8. Consider the following circuit:



Compute the current flowing up through battery $\mathcal{E}_1$. [Hint: Reduce circuit before applying loop rules]

9. An electrical circuit is shown below. All resistors have resistance R, and all batteries have voltage V.



What is the current through the resistor indicated by the dashed box? Make clear the direction of current flow.