

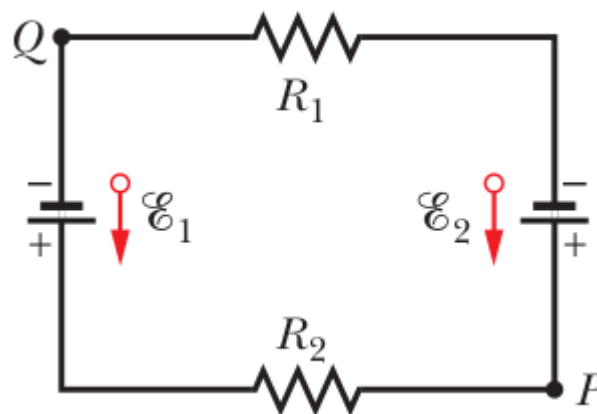
05 – Electric current, circuits (Ch. 26-27)

$$k = 1/4\pi\epsilon_0 = 8.99 \cdot 10^9 \text{ N m}^2/\text{C}^2 ; e = 1.60 \cdot 10^{-19} \text{ C} ; \epsilon_0 = 8.854 \cdot 10^{-12} \text{ F/m}$$

1) During the 4.0 min a 5.0 A current is set up in a wire, how many (a) coulombs and (b) electrons pass through any cross section across the wire's width?

7) A fuse in an electric circuit is a wire that is designed to melt, and thereby open the circuit, if the current exceeds a predetermined value. Suppose that the material to be used in a fuse melts when the current density rises to 440 A/cm^2 . What diameter of cylindrical wire should be used to make a fuse that will limit the current to 0.50 A?

2) In the figure, the ideal batteries have emfs $E_1 = 150 \text{ V}$ and $E_2 = 50 \text{ V}$ and the resistances are $R_1 = 3.0 \Omega$ and $R_2 = 2.0 \Omega$. If the potential at P is 100 V, what is it at Q?



8) A certain car battery with a 12.0 V emf has an initial charge of 120 A·h. Assuming that the potential across the terminals stays constant until the battery is completely discharged, for how many hours can it deliver energy at the rate of 100 W?

12) The figure shows a resistor of resistance $R = 6.00 \Omega$ connected to an ideal battery of emf $E = 12.0 \text{ V}$ by means of two copper wires. Each wire has length 20.0 cm and radius 1.00 mm. In dealing with such circuits, we generally neglect the potential differences along the wires and the transfer of energy to thermal energy in them. Check the validity of this neglect for the circuit of the figure: What is the potential difference across (a) the resistor and (b) each of the two sections of wire? At what rate is energy lost to thermal energy in (c) the resistor and (d) each section of wire?

