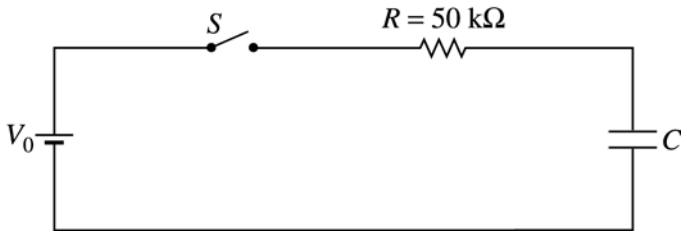


E&M 2.

Your engineering firm has built the RC circuit shown above. The current is measured for the time t after the switch is closed at $t = 0$ and the best-fit curve is represented by the equation $I(t) = 5.20\, e^{-t/10}$, where I is in milliamperes and t is in seconds.

(a) Determine the value of the charging voltage V_0 predicted by the equation.

(b) Determine the value of the capacitance C predicted by the equation.

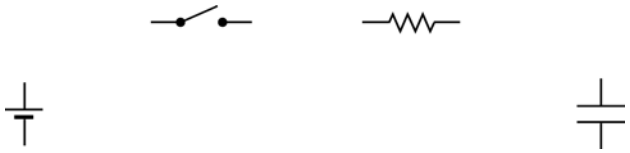
(c) The charging voltage is measured in the laboratory and found to be greater than predicted in part (a).

i. Give one possible explanation for this finding.

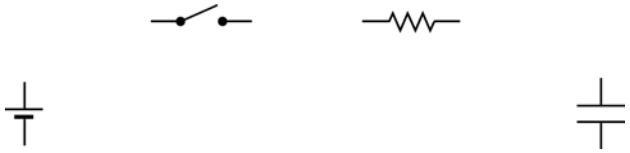
ii. Explain the implications that your answer to part i has for the predicted value of the capacitance.

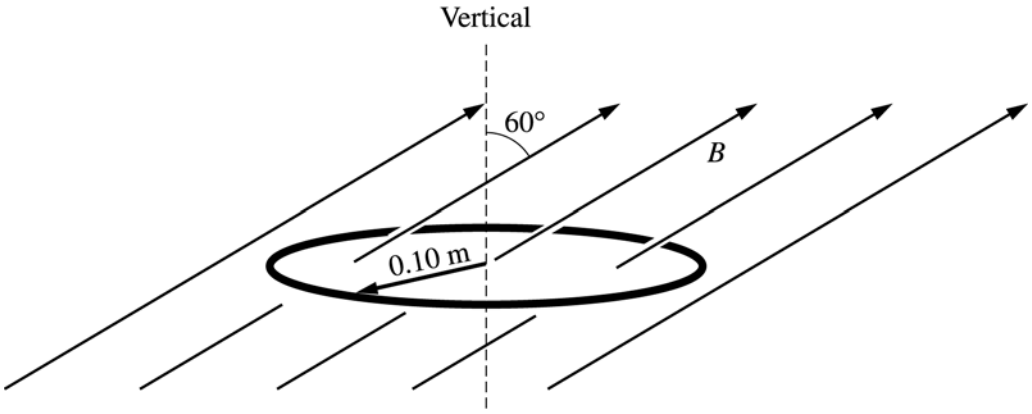
(d) Your laboratory supervisor tells you that the charging time must be decreased. You may add resistors or capacitors to the original components and reconnect the RC circuit. In parts i and ii below, show how to reconnect the circuit, using either an additional resistor or a capacitor to decrease the charging time.

i. Indicate how a resistor may be added to decrease the charging time. Add the necessary resistor and connections to the following diagram.



ii. Instead of a resistor, use a capacitor. Indicate how the capacitor may be added to decrease the charging time. Add the necessary capacitor and connections to the following diagram.





E&M 3.

A circular wire loop with radius 0.10 m and resistance 50 Ω is suspended horizontally in a magnetic field of magnitude B directed upward at an angle of 60° with the vertical, as shown above. The magnitude of the field in teslas is given as a function of time t in seconds by the equation $B = 4(1 - 0.2t)$.

(a) Determine the magnetic flux ϕ_m through the loop as a function of time.

(b) Graph the magnetic flux ϕ_m as a function of time on the axes below.