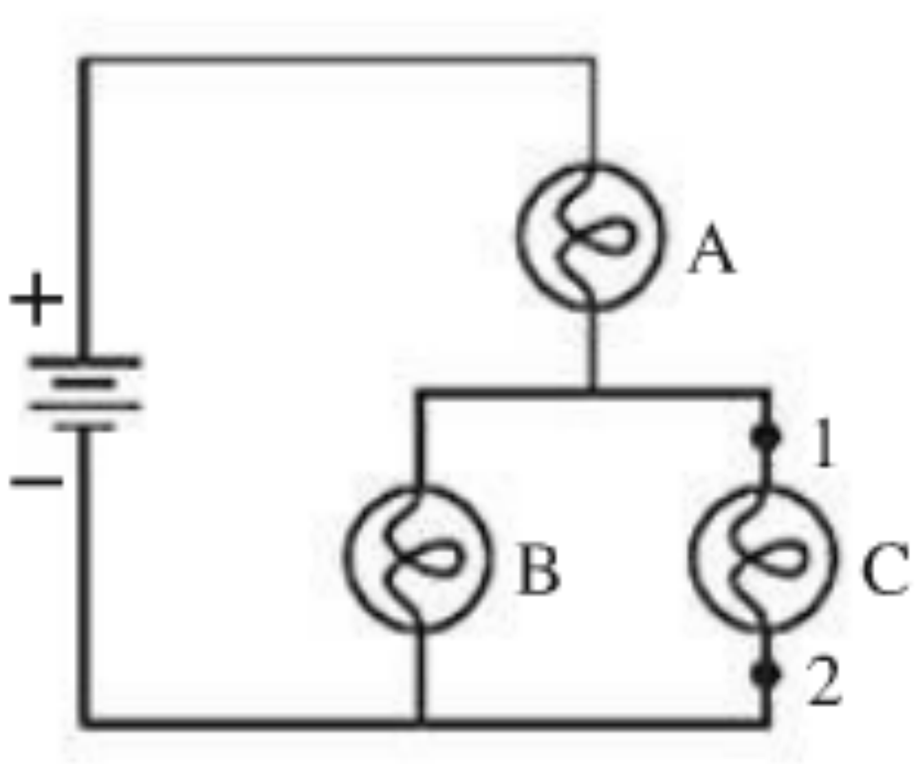
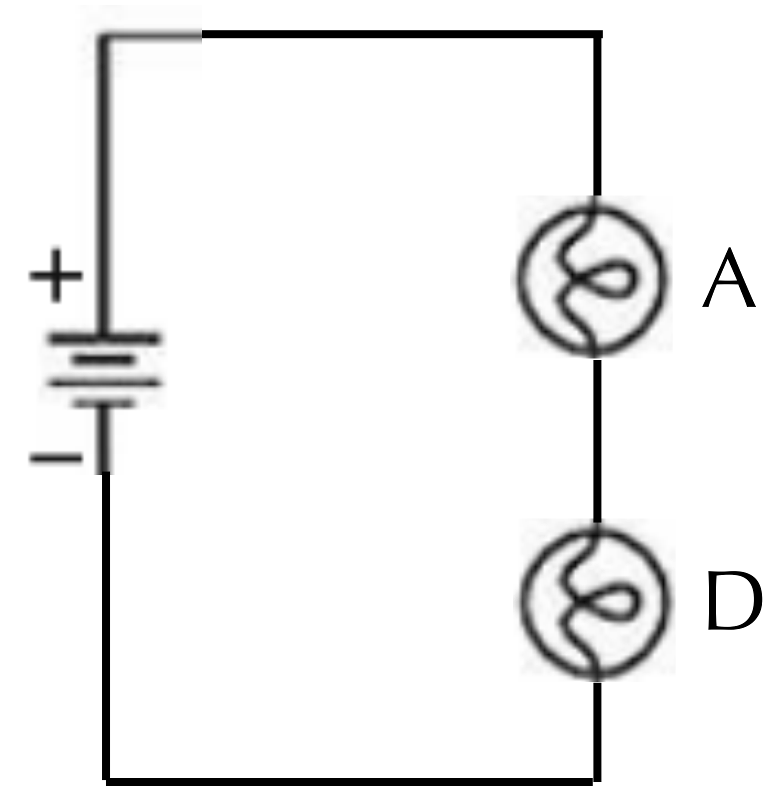

PH 220
Lance Nelson

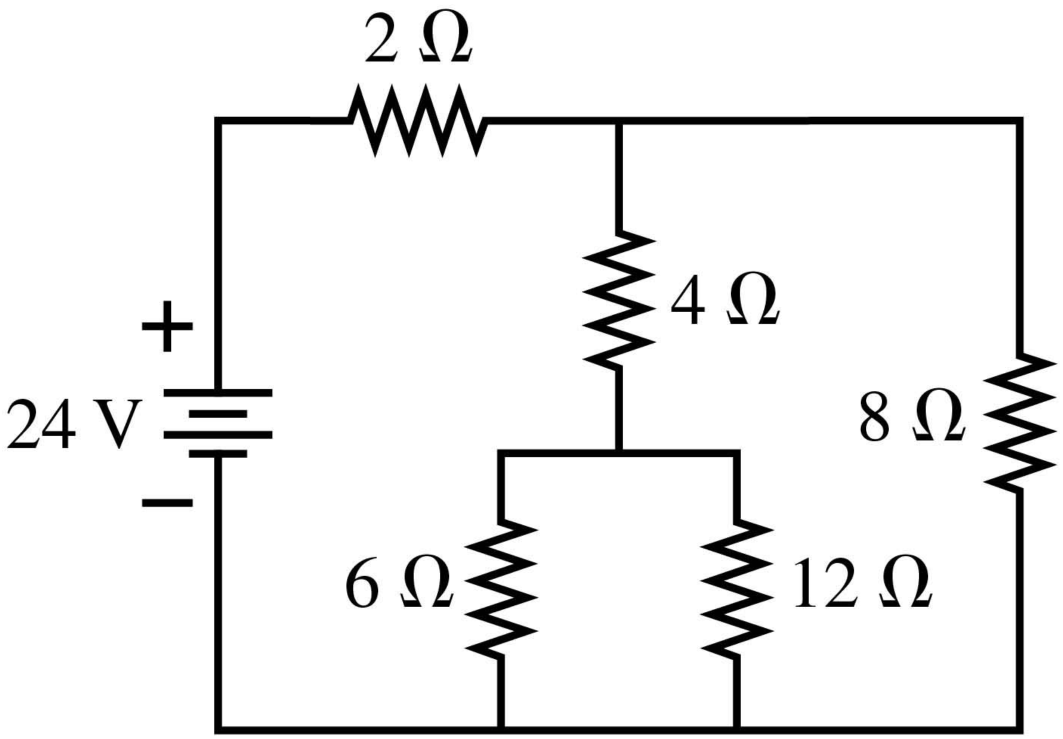
How does the resistance of D compare to that of A:

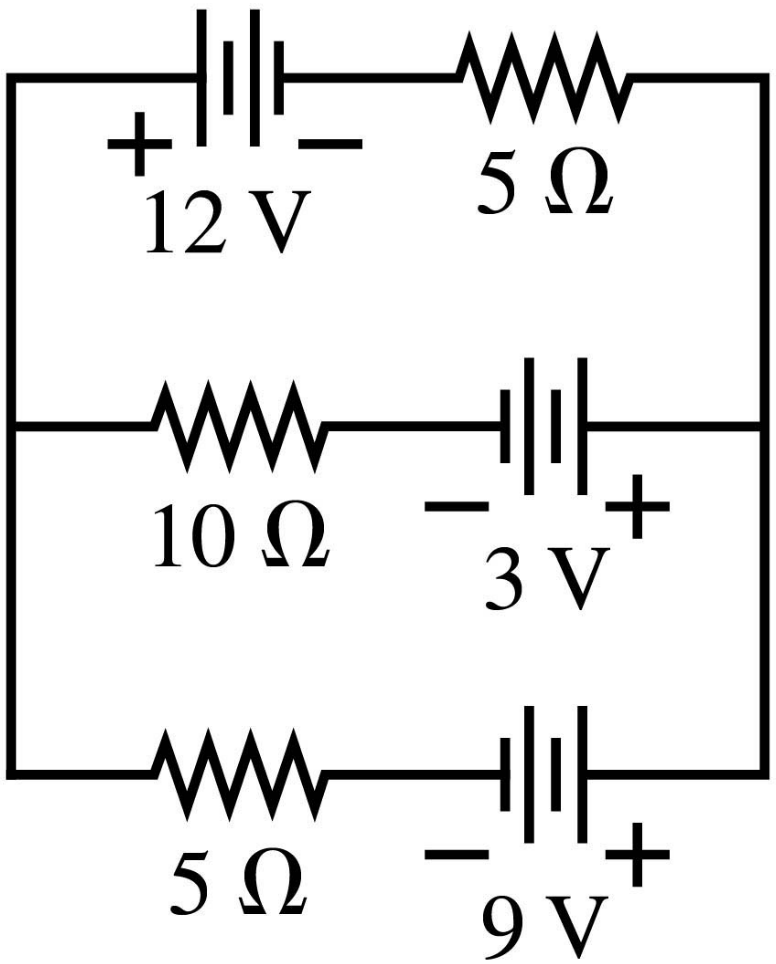
a) before the wire is placed between 1 and 2
b) after the wire is placed between 1 and 2





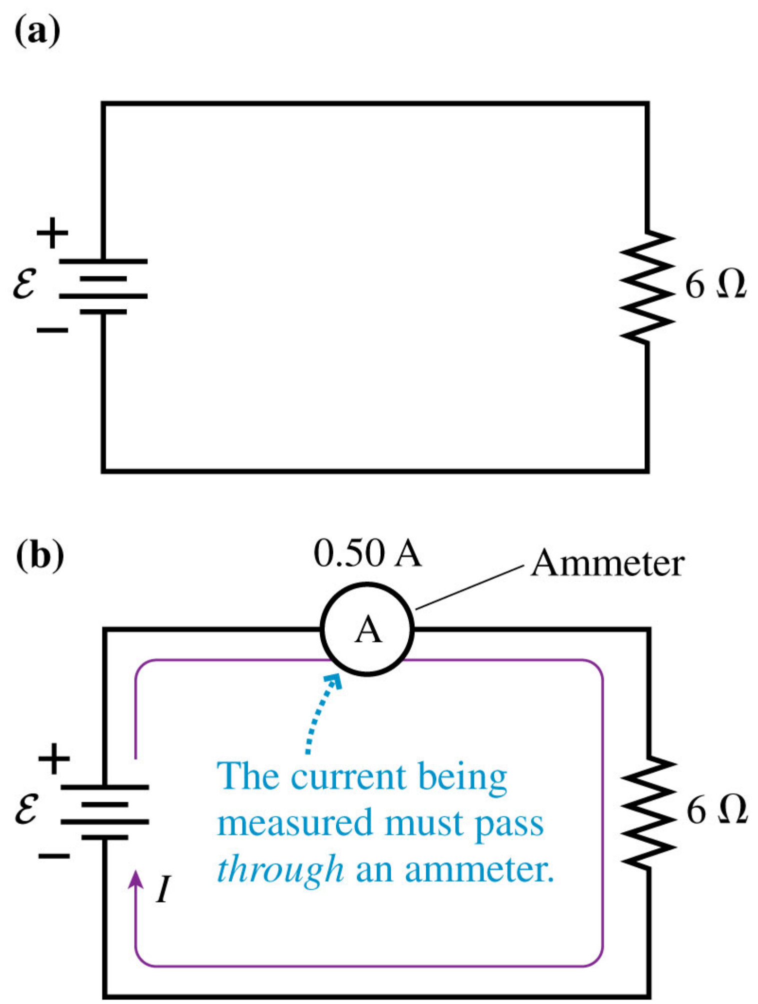
Compare the current in the circuit before the short to after the short.

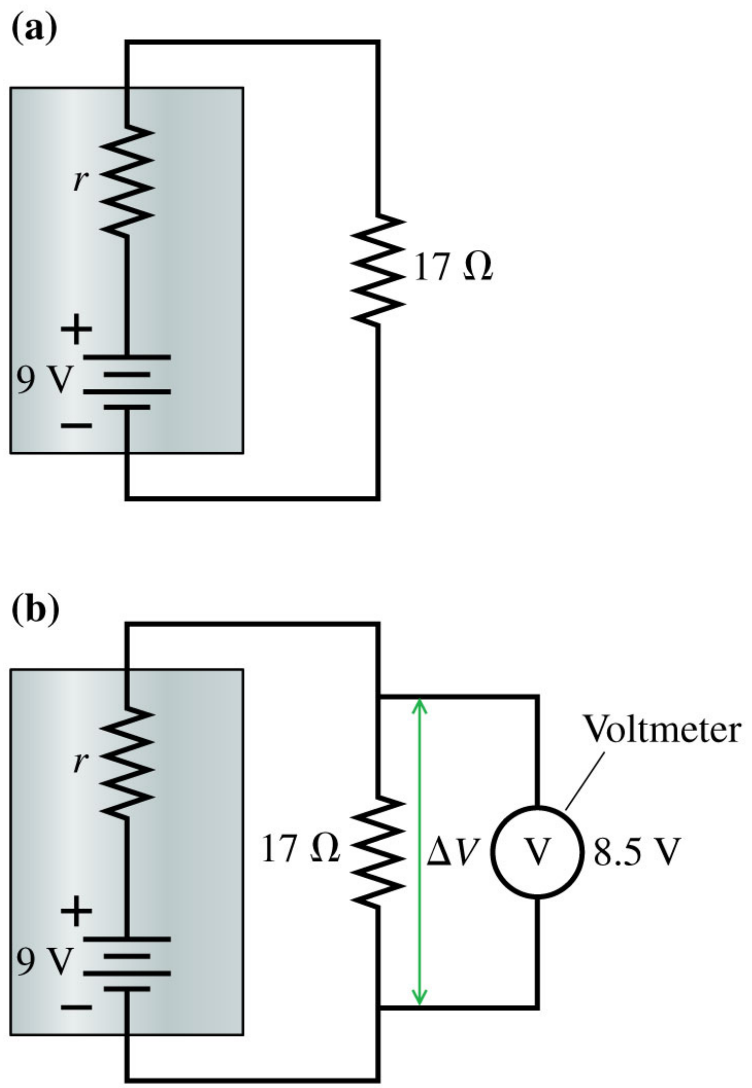

2 Ω
4 Ω
8 Ω
+
24 V
−
6 Ω
12 Ω



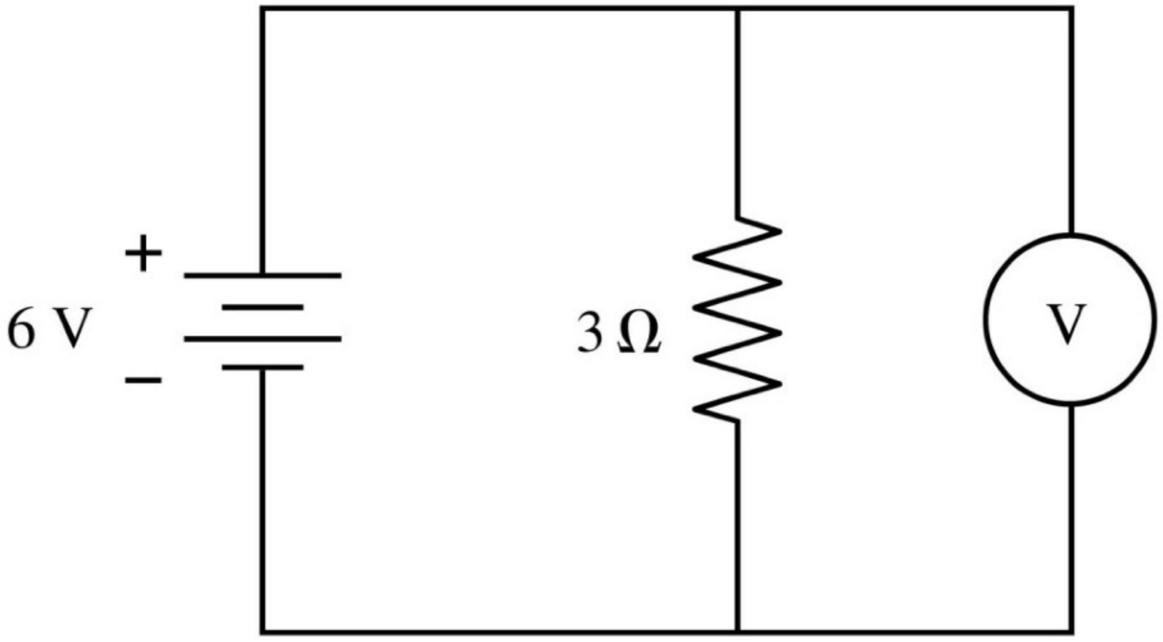
12 V
5 Ω
10 Ω
3 V
5 Ω
9 V

Ammeters and Voltmeters



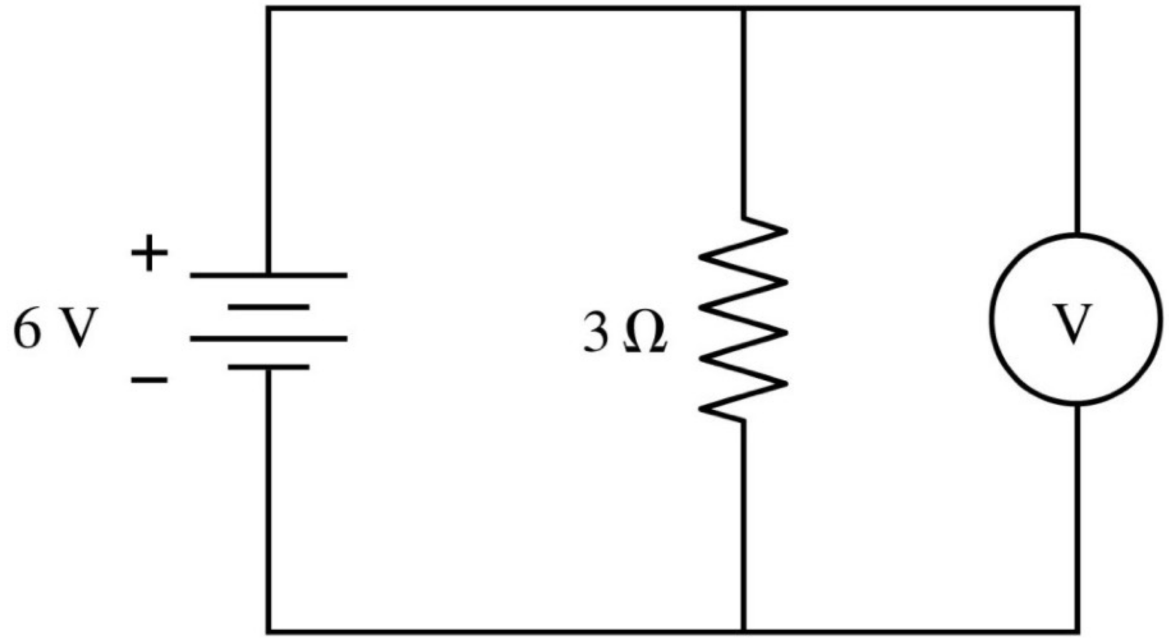


What does the voltmeter read?



What does the voltmeter read?

A. 6 V.
B. 3 V.
C. 2 V.
D. Some other value.
E. Nothing because this will fry the meter.



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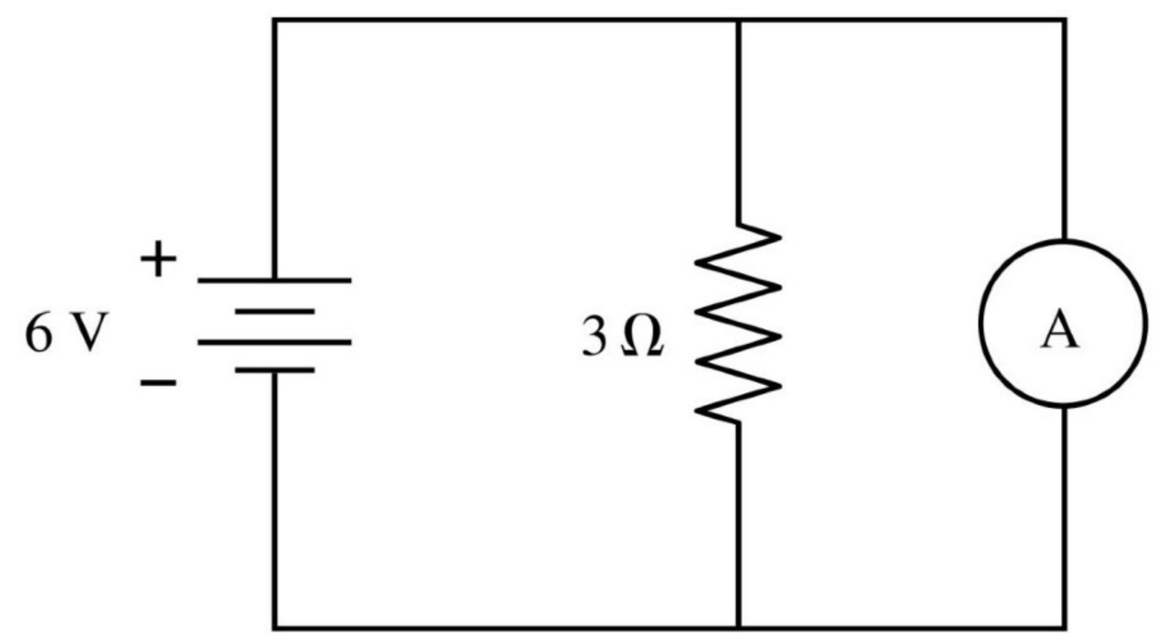
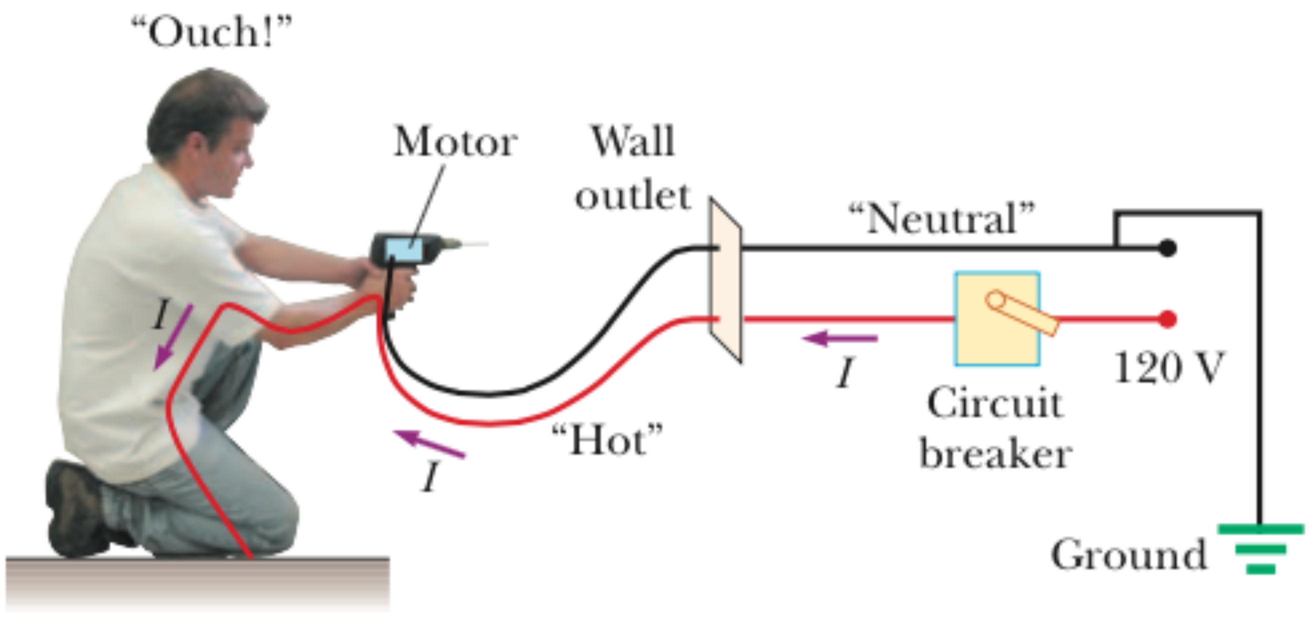
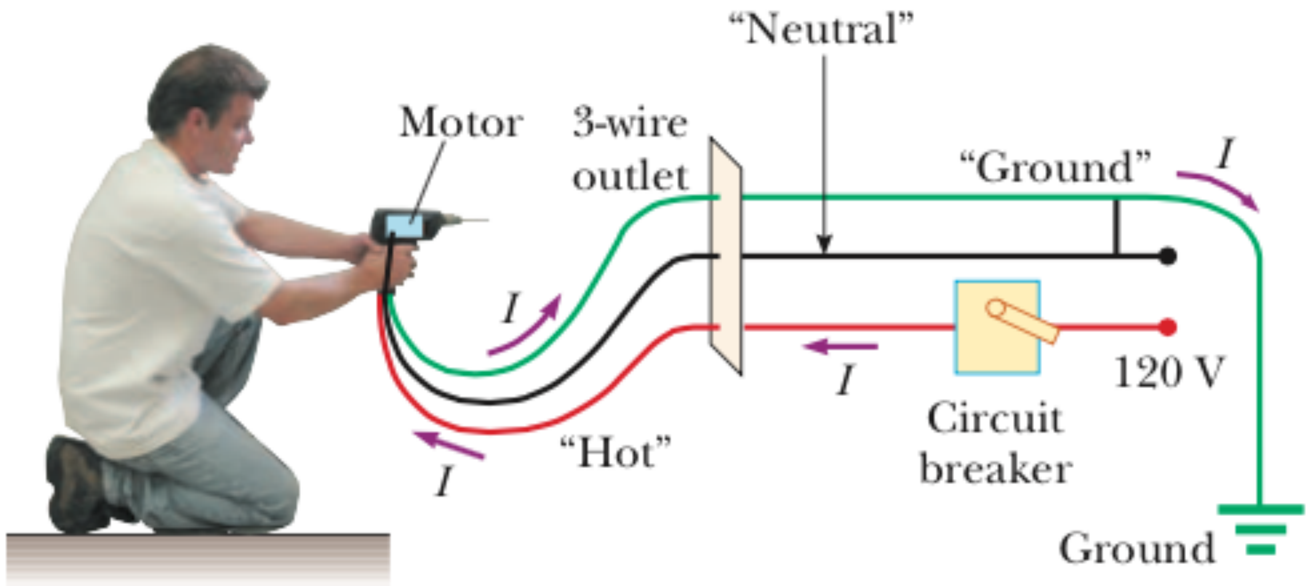


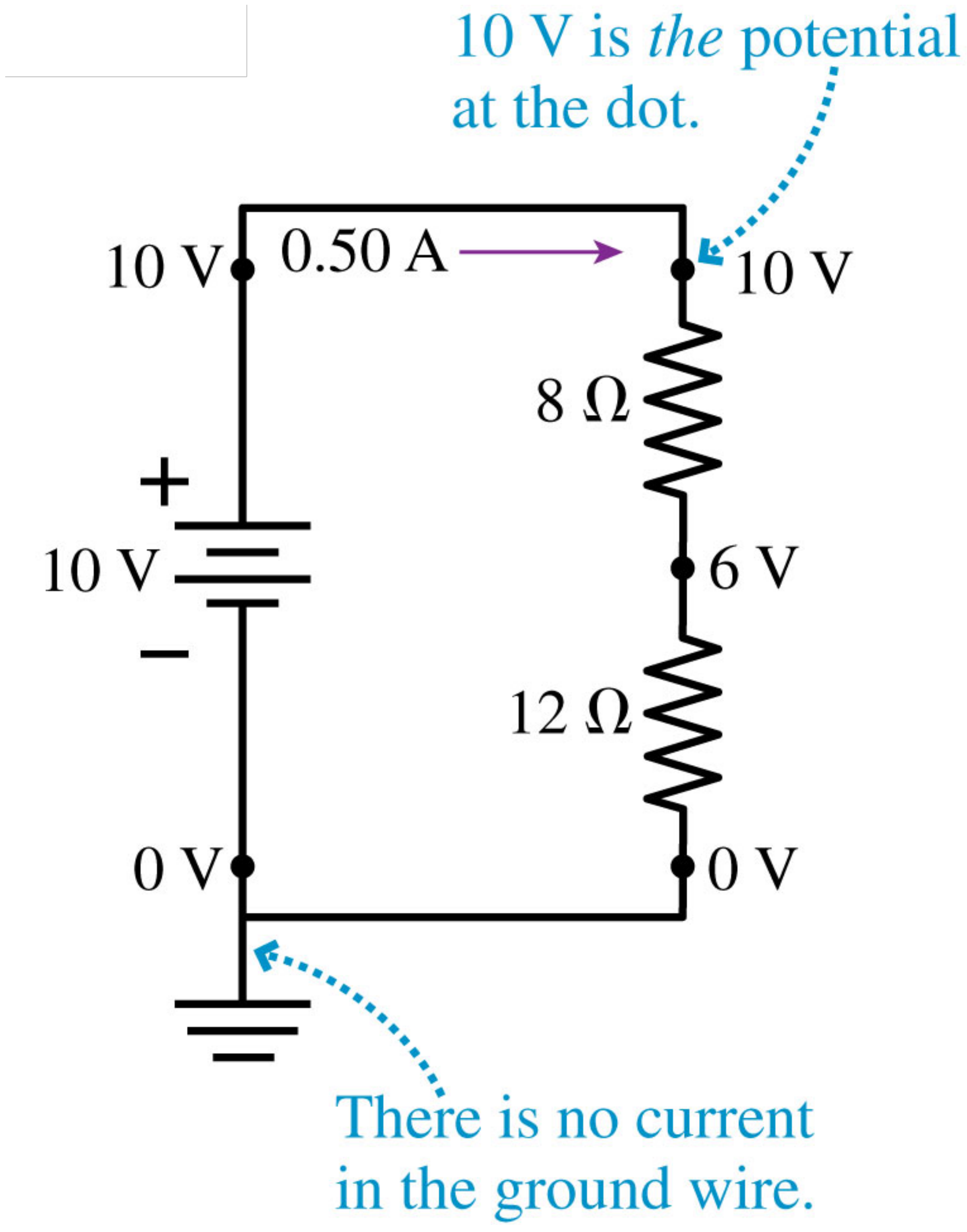
Getting Grounded



(a)

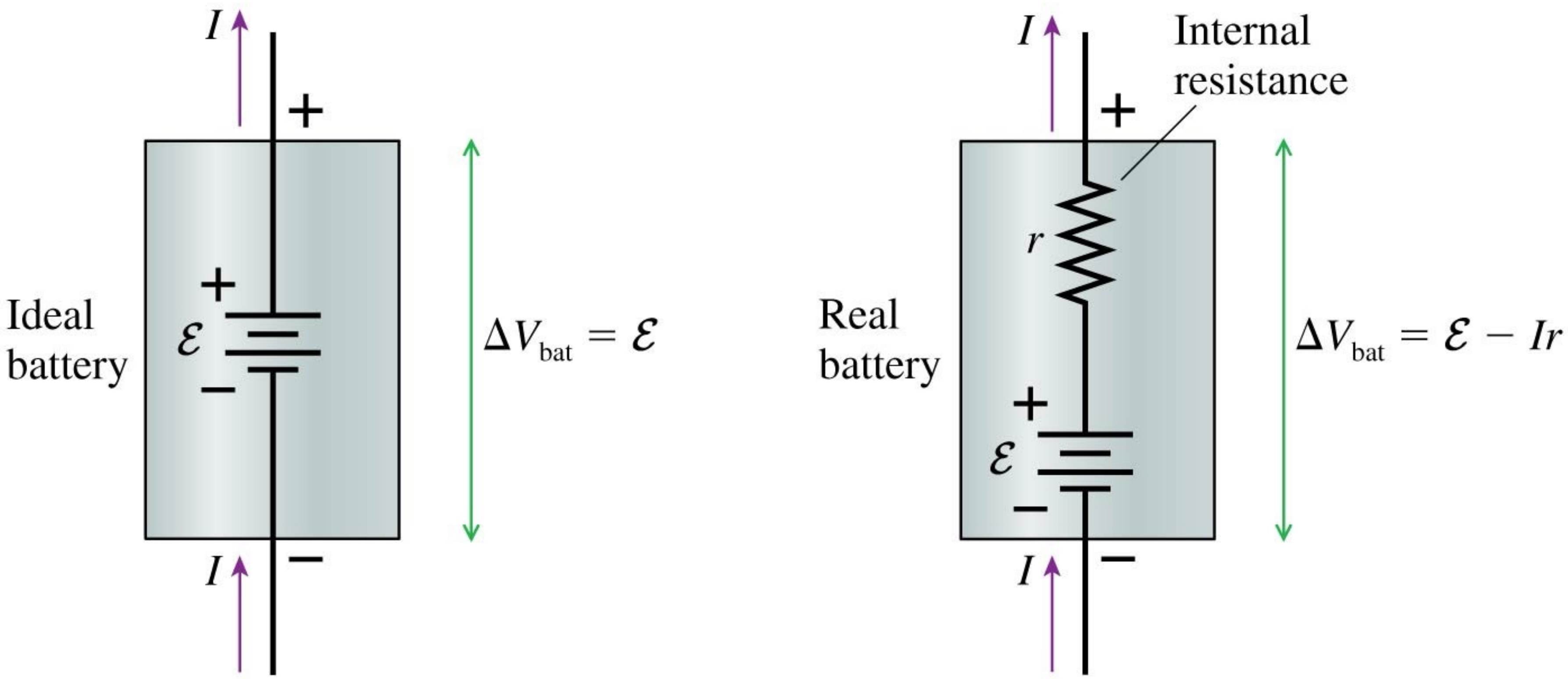


Grounding a circuit

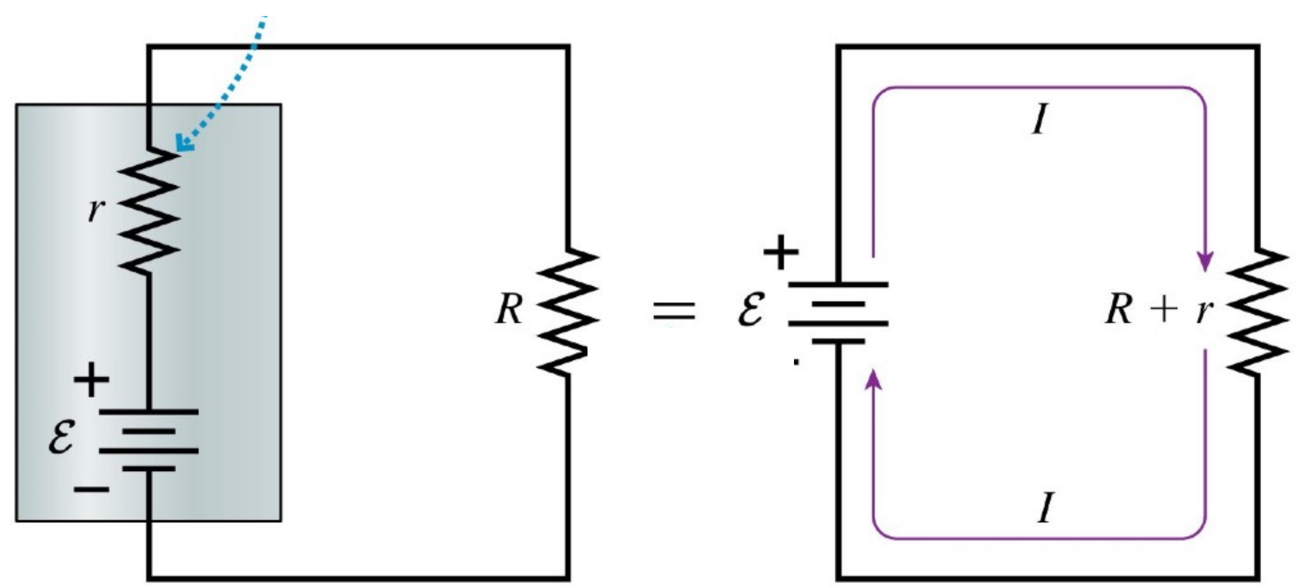


Real Batteries

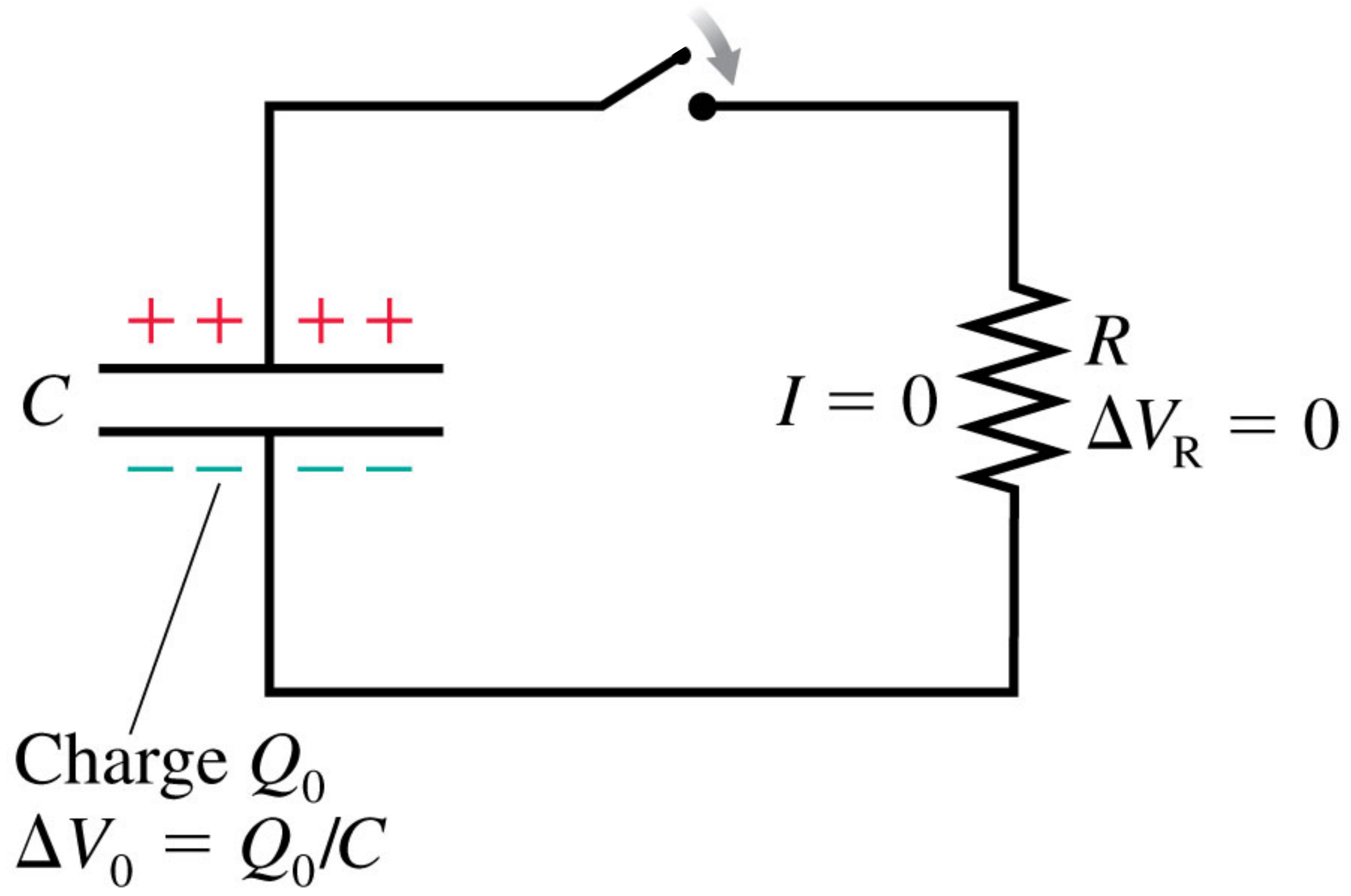
The batterie's internal resistance limits the max current.



$$\Delta V_R = IR = \frac{\mathcal{E}}{R+r} R$$



Without looking in the book. Sketch the Q vs. time curve for the capacitor.



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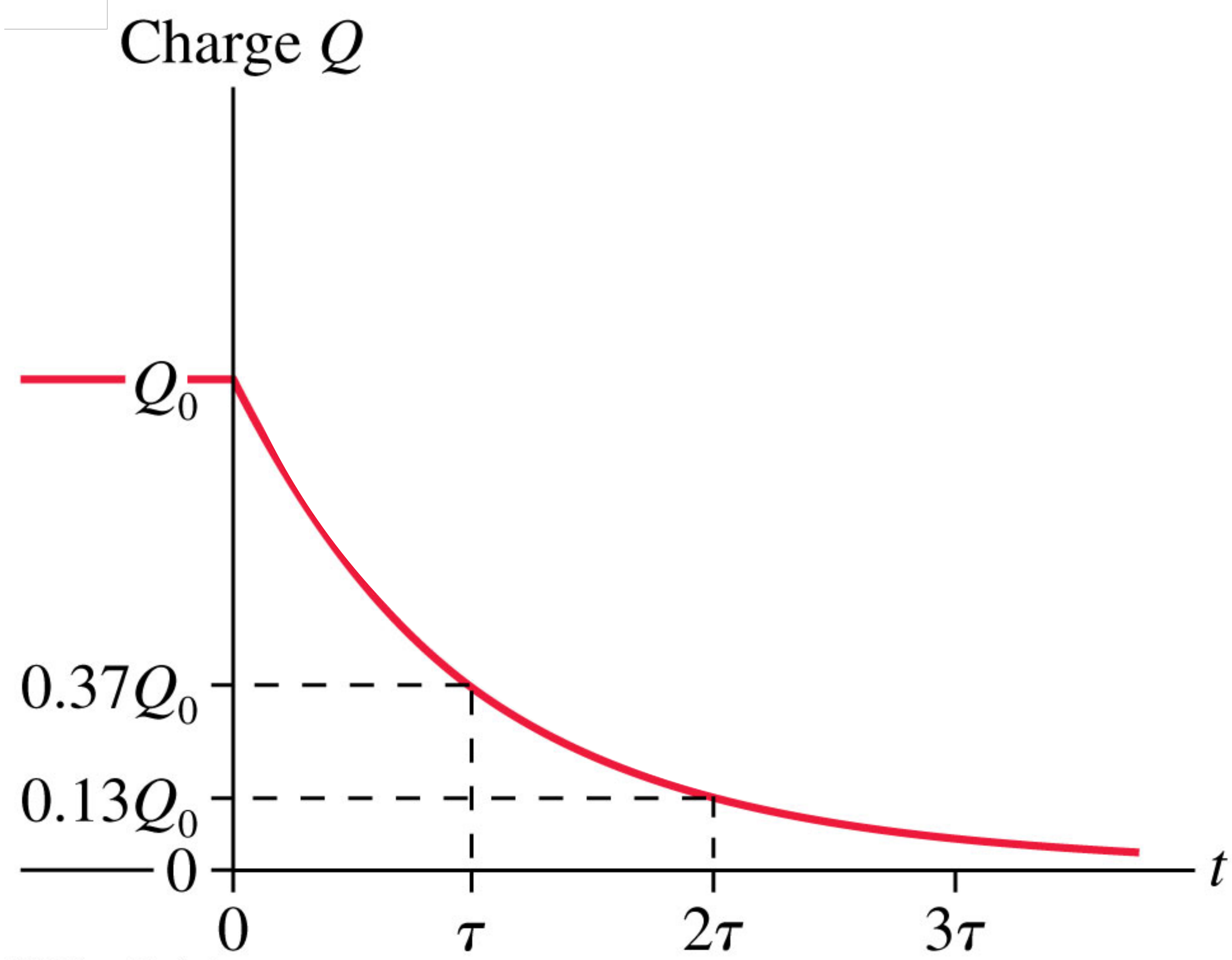
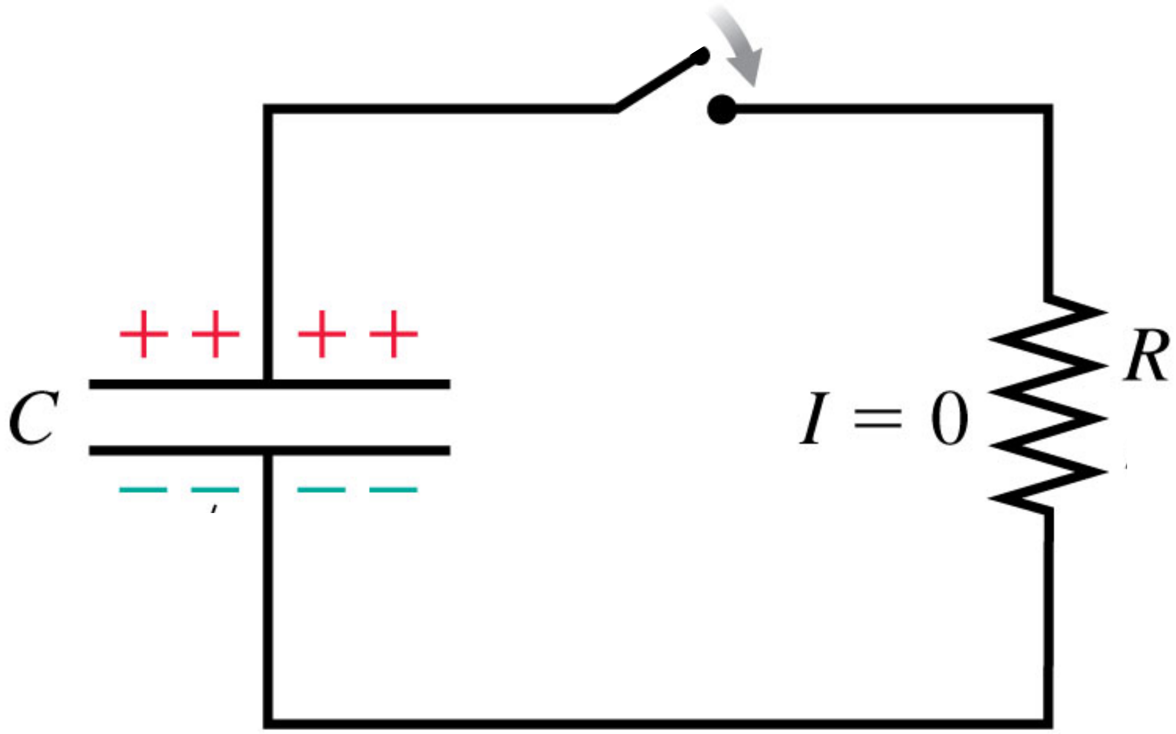


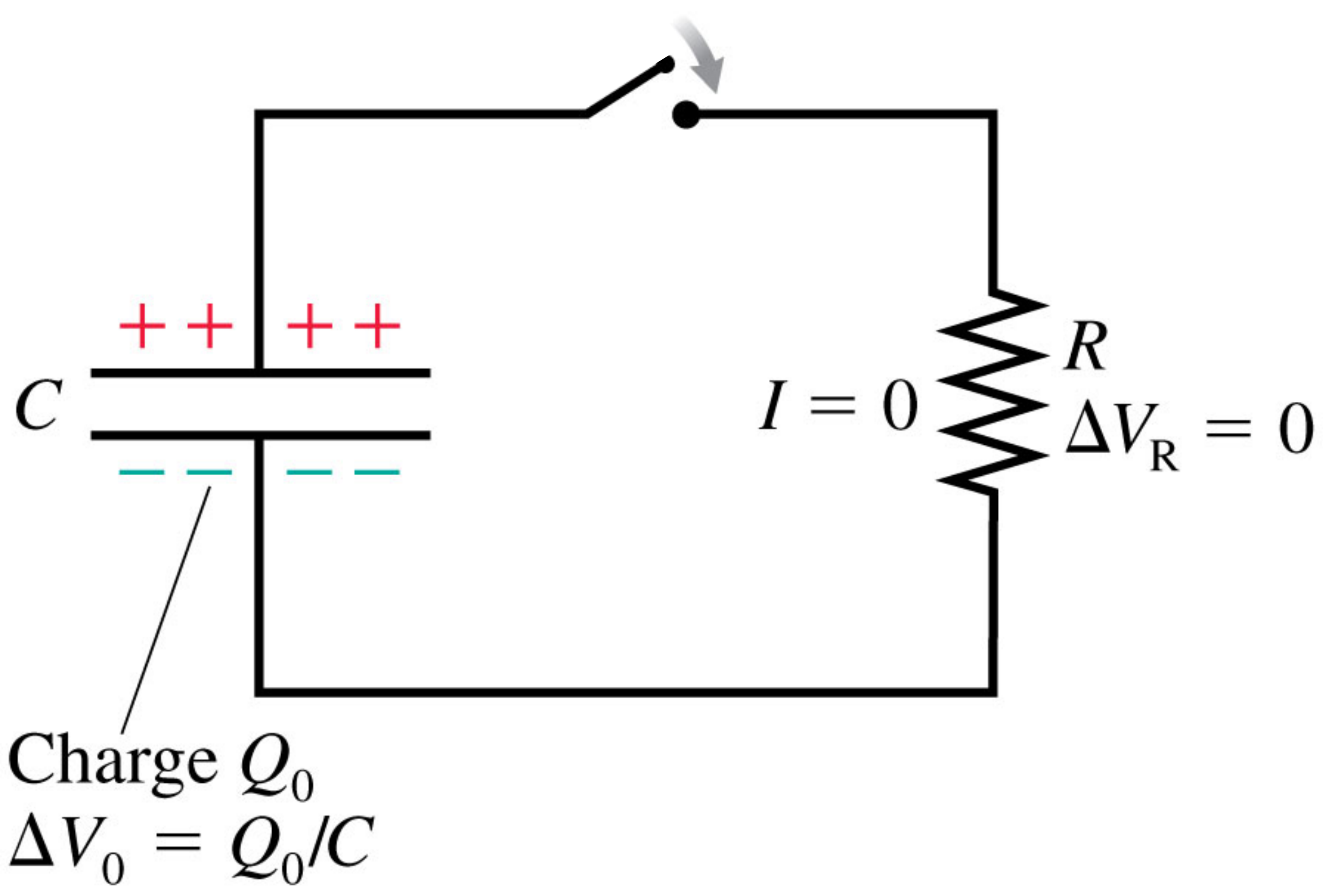
$= 0$



C
R
I = 0

The Math

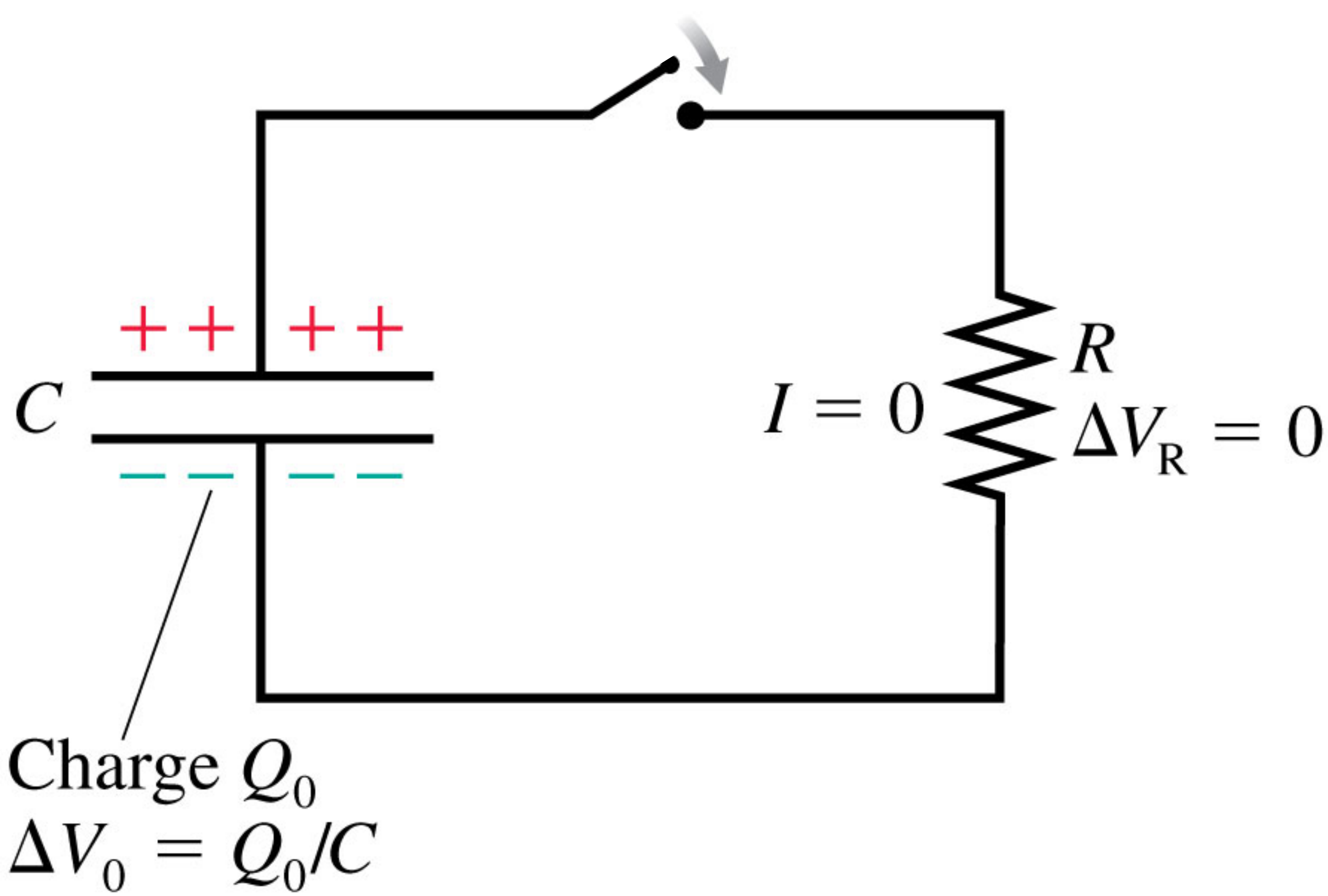
Write down Kirchoff's
loop rule for this circuit



The Math

Write down Kirchoff's loop rule for this circuit

$$\Delta V_{\text{cap}} + \Delta V_{\text{res}} = \frac{Q}{C} - IR = 0$$



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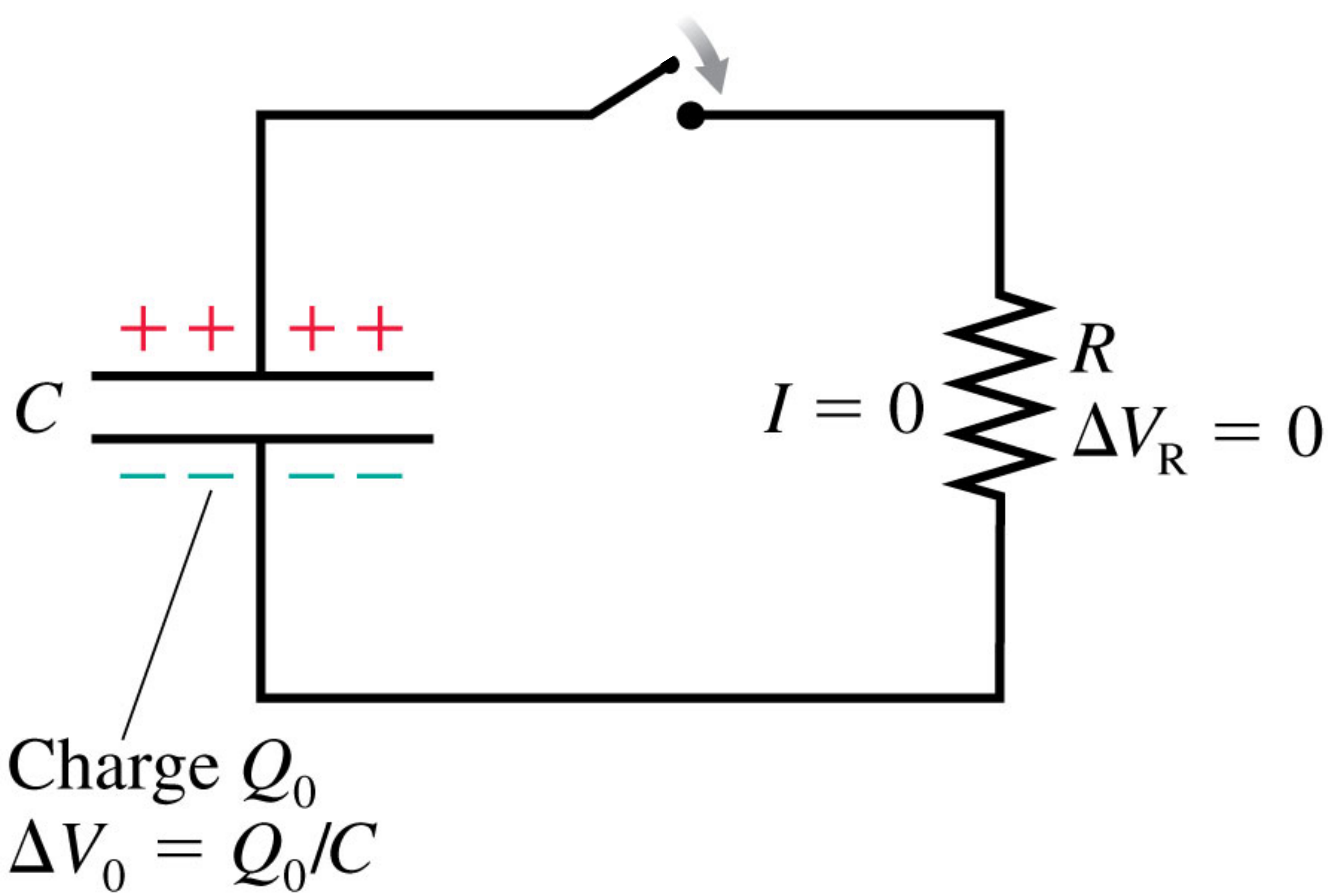

$$\Delta V_{cap} + \Delta V_{res} = \frac{Q}{C} - IR = 0$$

$$I = -\frac{dQ}{dt}$$

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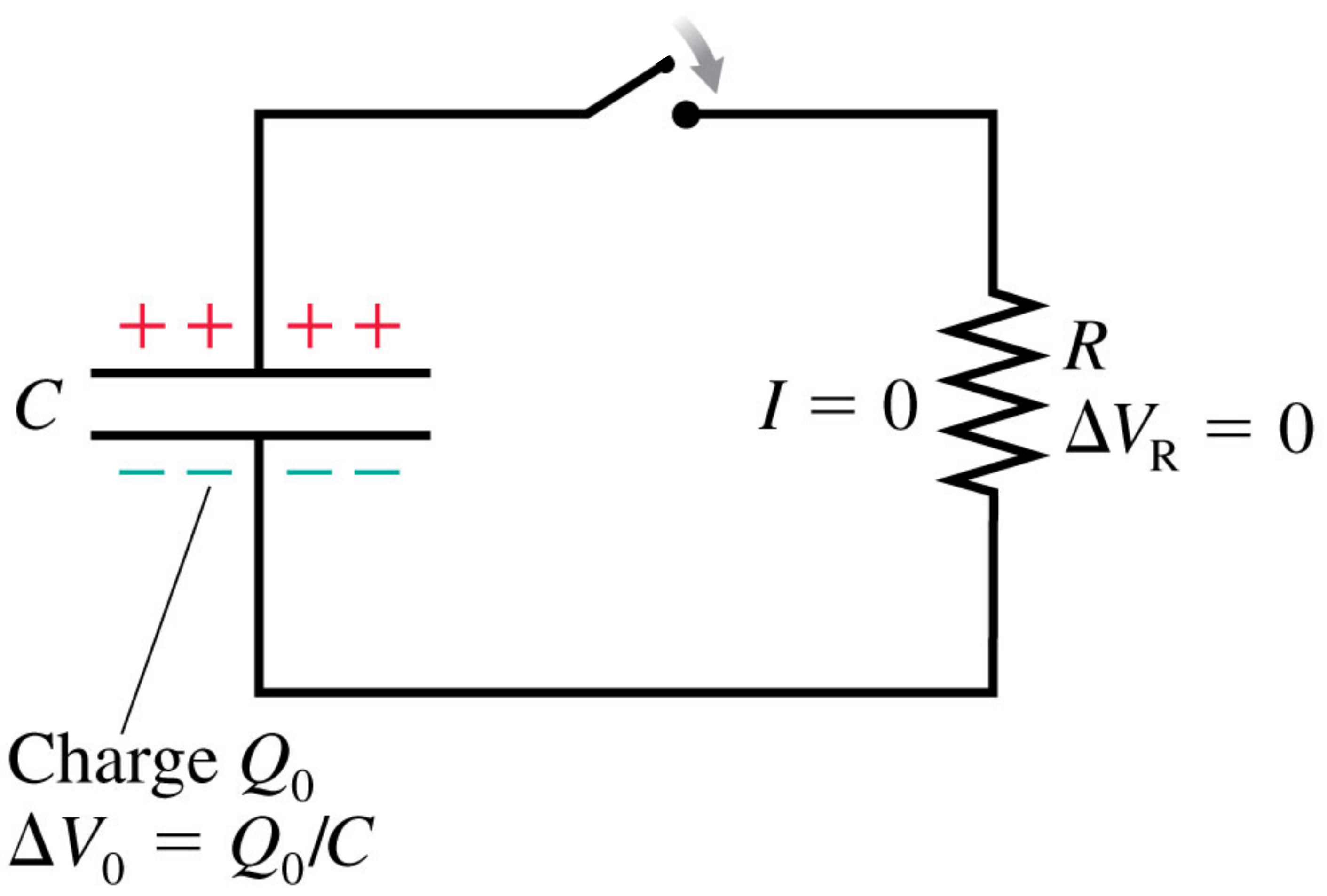

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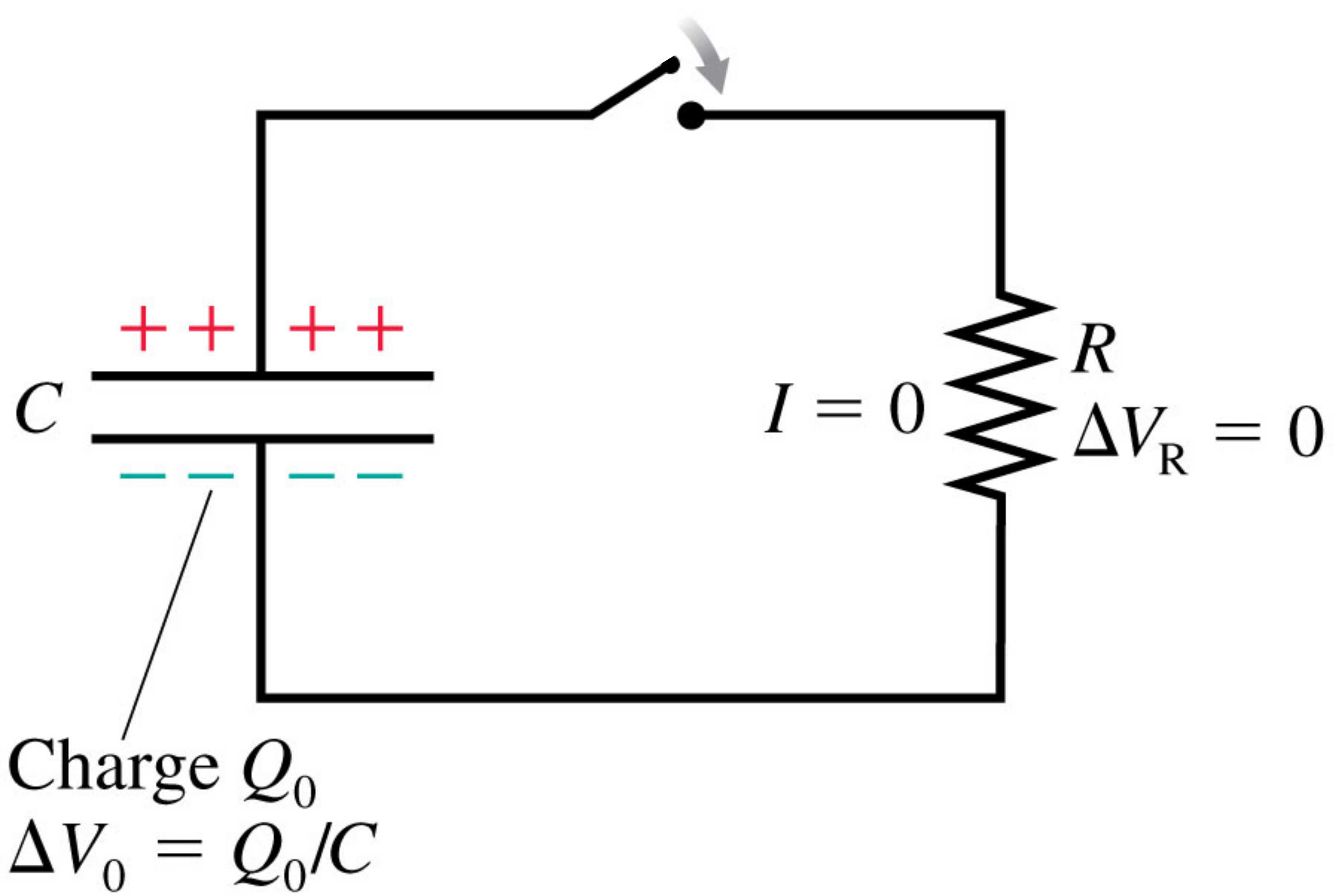

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a) Gather all the variables with Q in them to one side.
b) Integrate both sides.

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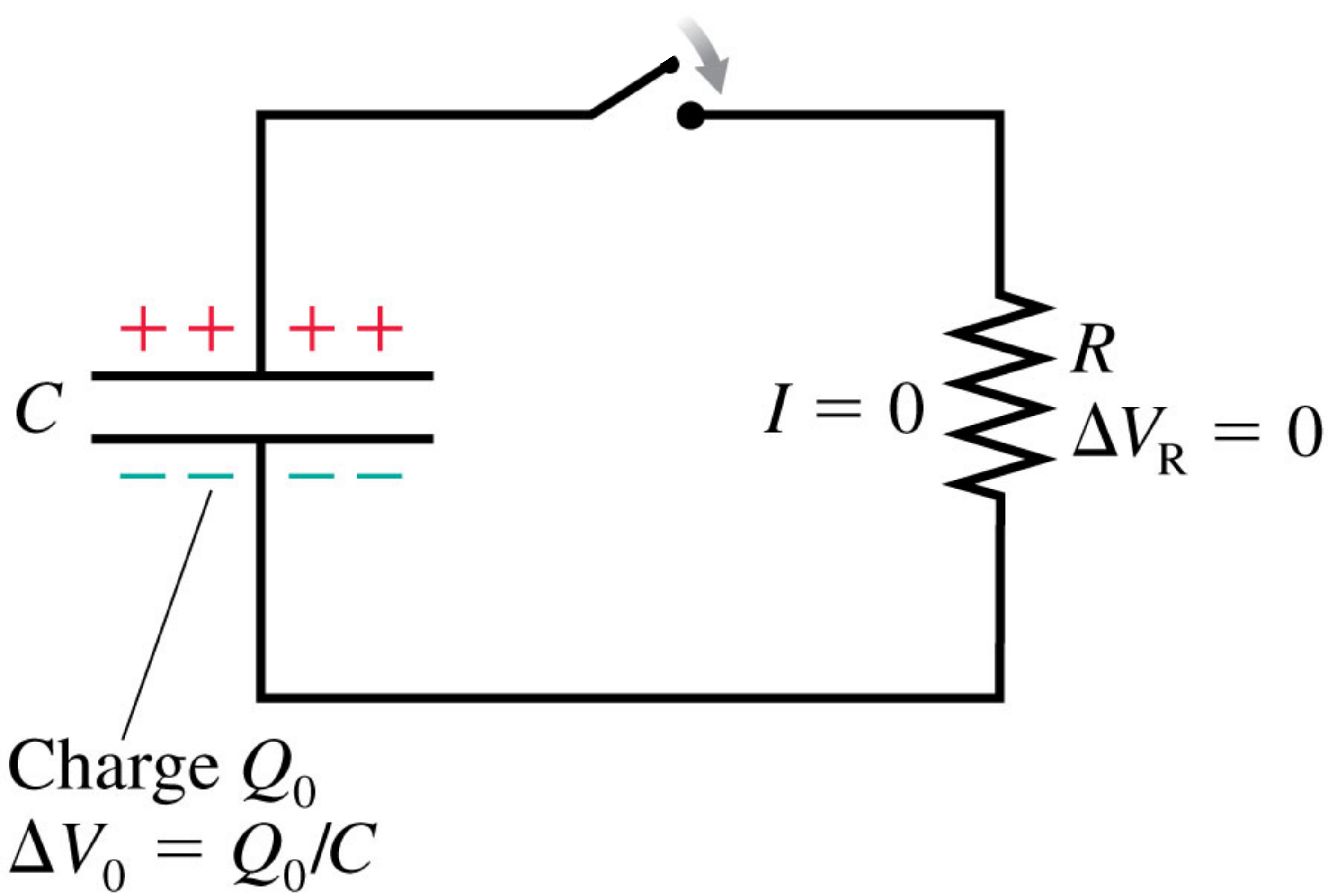

$$I = -\frac{dQ}{dt}$$

$$\frac{dQ}{dt} + \frac{Q}{RC} = 0$$

a) Gather all the variables with Q in them to one side.
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$$\int_{Q_0}^{Q} \frac{dQ}{Q} = -\frac{1}{RC}\int_0^t dt$$

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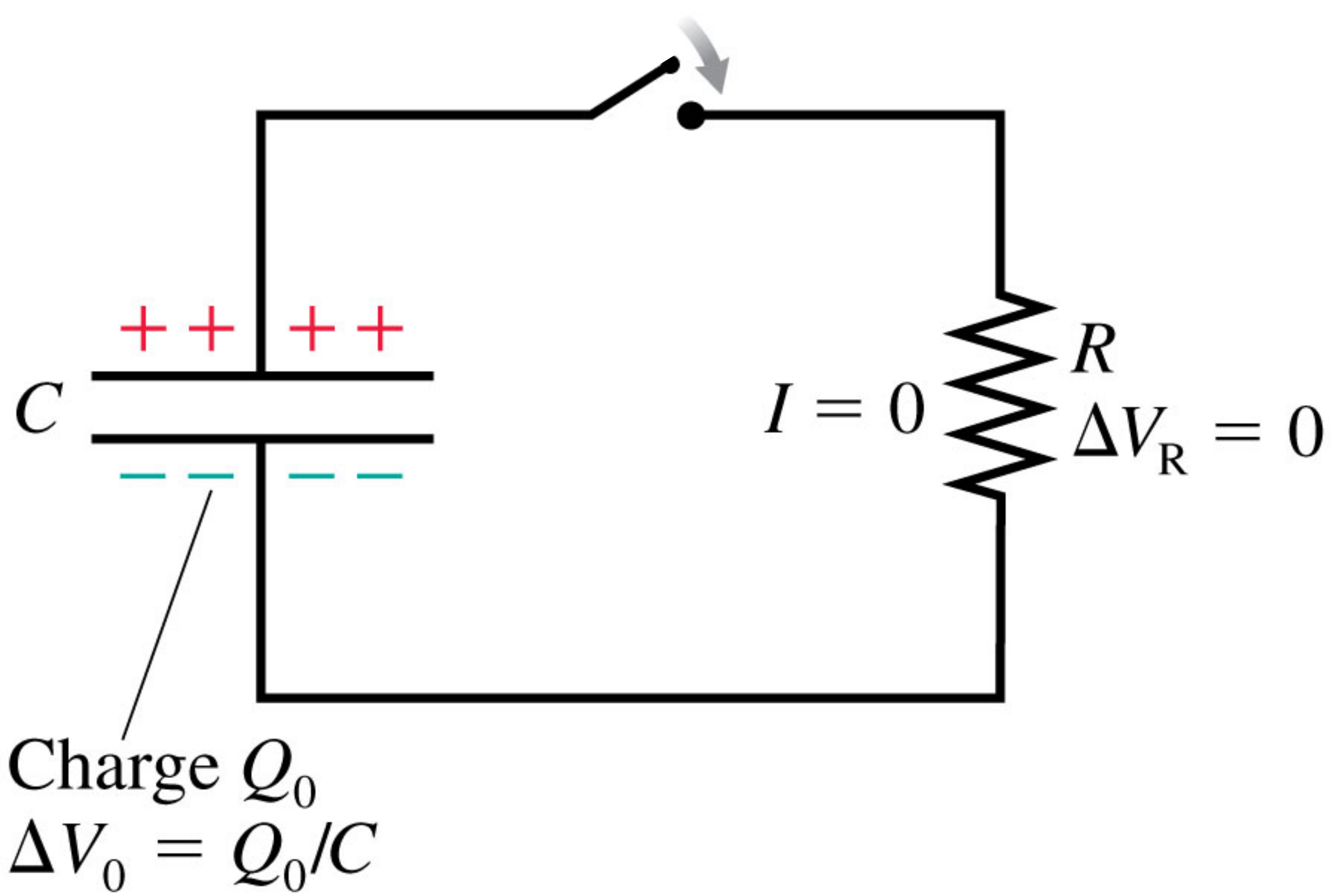

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$$\boxed{Q = Q_0 e^{-t/\tau}}$$

$$\tau = RC$$

The Math

Write down Kirchoff's
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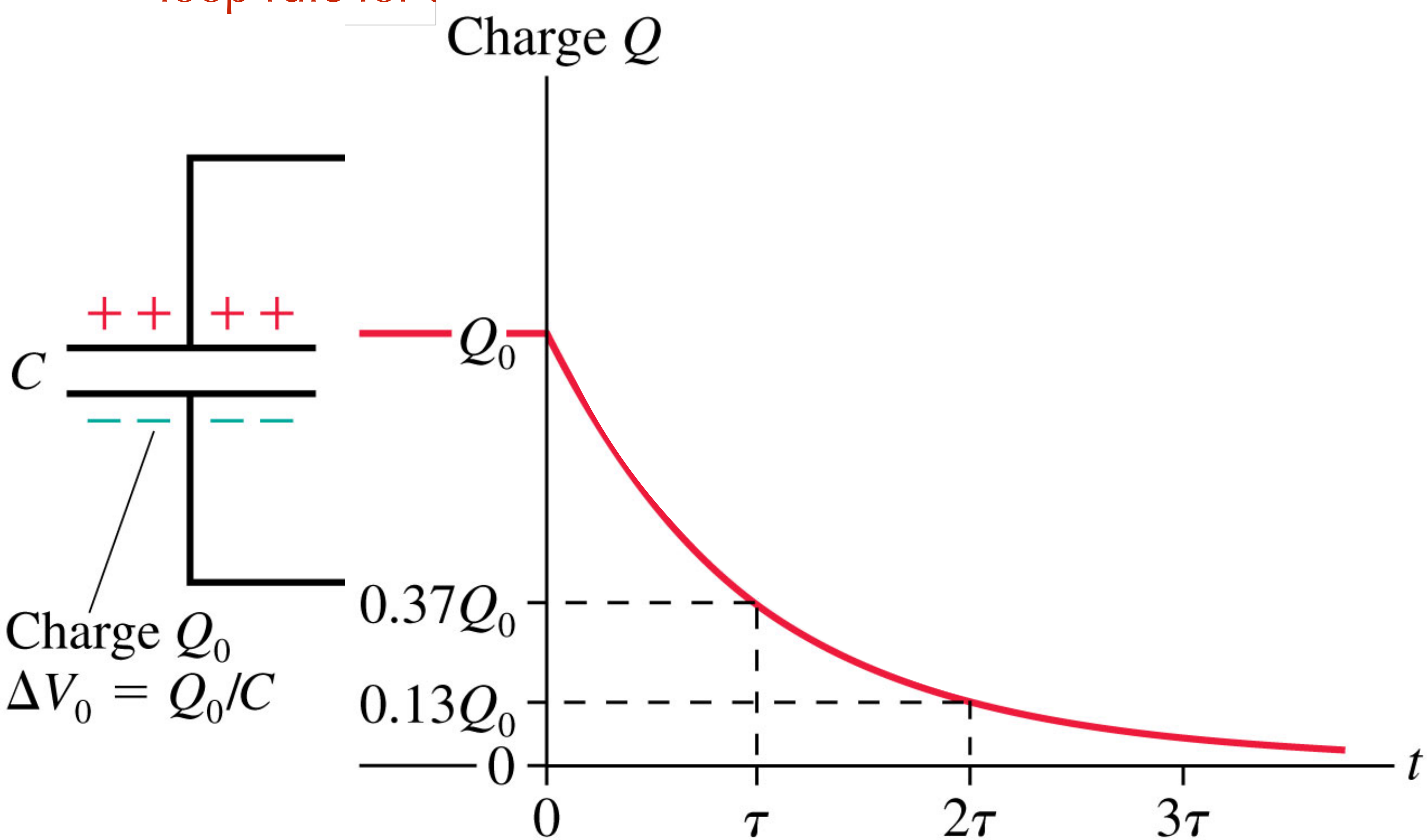

$$\frac{dQ}{dt}$$

$$\frac{Q}{C} = 0$$

the
with Q in
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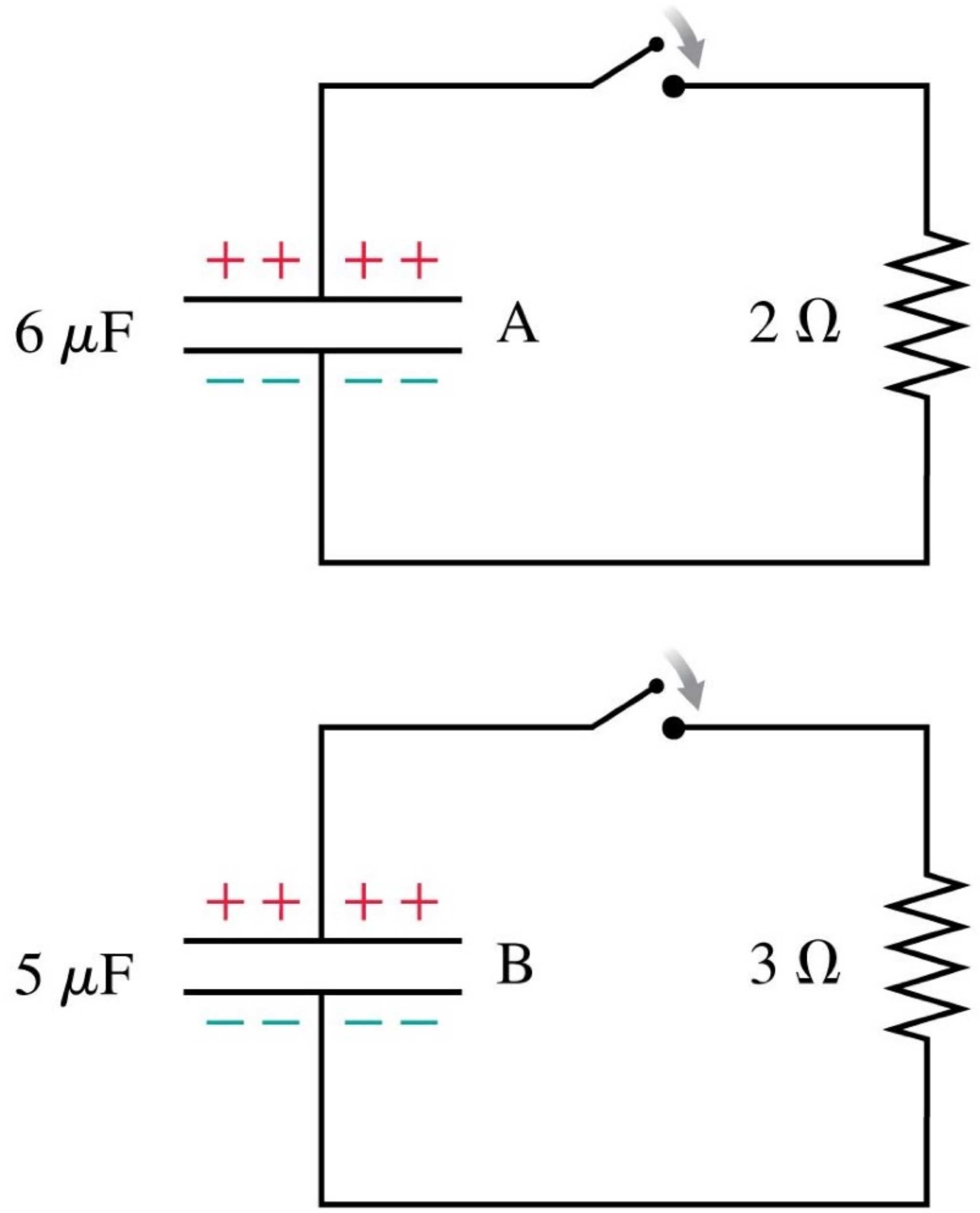
both sides.

$$\boxed{Q = Q_0 e}$$

$$\tau = RC$$

$$\int_{Q_0} \frac{dQ}{Q} = -\frac{1}{RC}\int_0^t dt$$

Which capacitor discharges more quickly after the switch is closed?



A. Capacitor A.

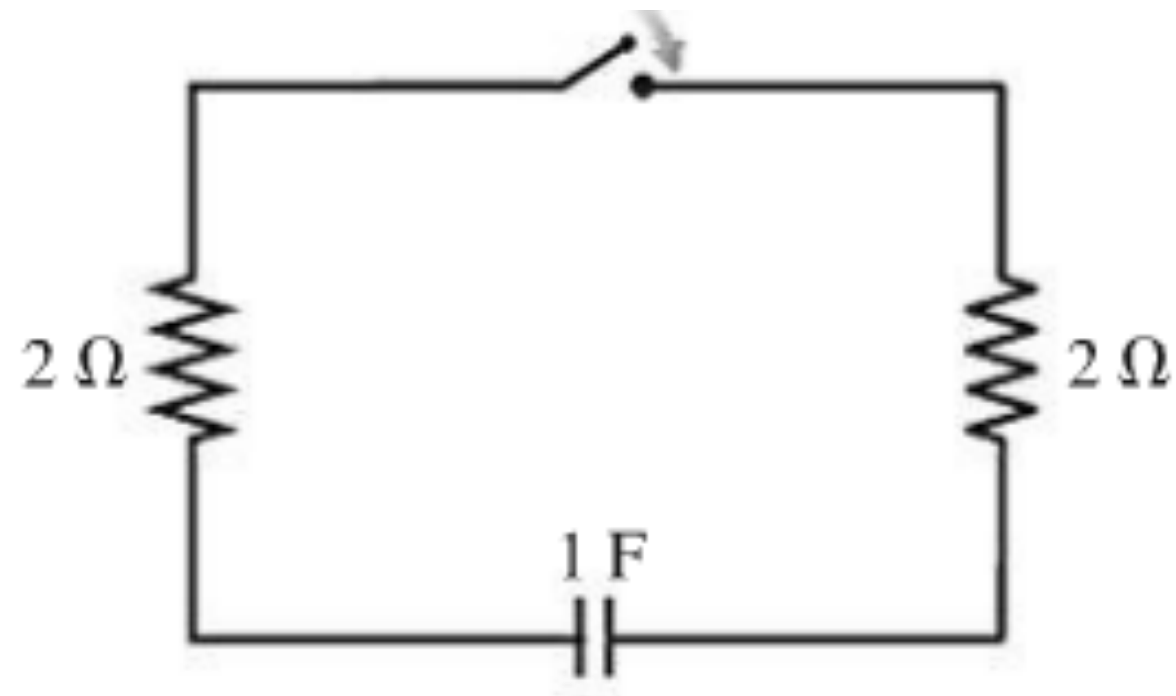
B. Capacitor B.

C. They discharge at the same rate.

D. Can't say without knowing the initial amount of charge.

What is the time constant for this RC circuit

a) 5 s   b) 4 s   c) 3s   d) 2s   e) 1s



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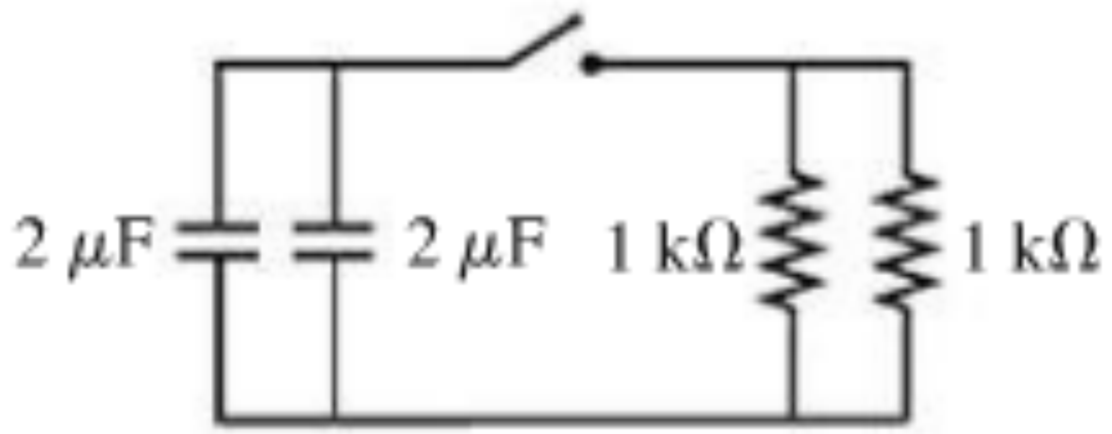

$$Q = Q_0 e^{-t/\tau}$$

If the charge on the capacitor decays exponentially, how does the voltage on the capacitor vary with time?

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What about the current through the resistor?

You'll need to do some math!

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$$I = -\frac{dQ}{dt} = \frac{Q_0}{\tau} e^{-t/\tau} = \frac{Q_0}{RC} e^{-t/\tau} = \frac{\Delta V_0}{R} e^{-t/\tau} = I_0 e^{-t/\tau}$$

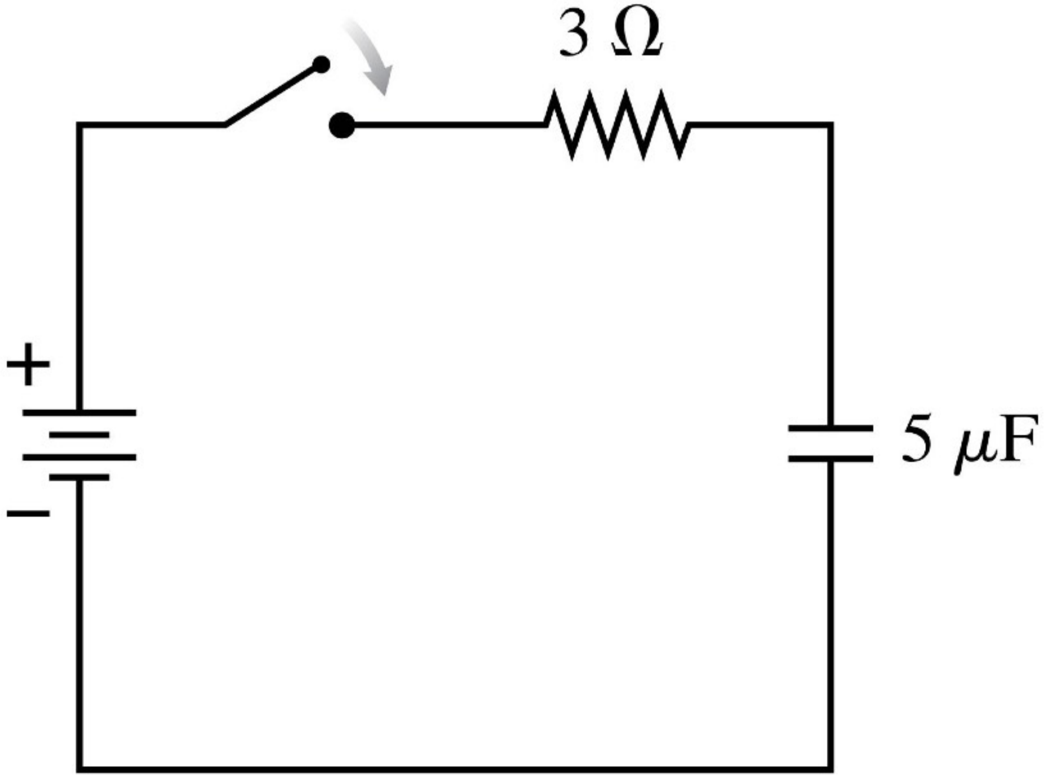
The capacitor is initially uncharged. Immediately after the switch closes, the capacitor voltage is

A. 0 V.

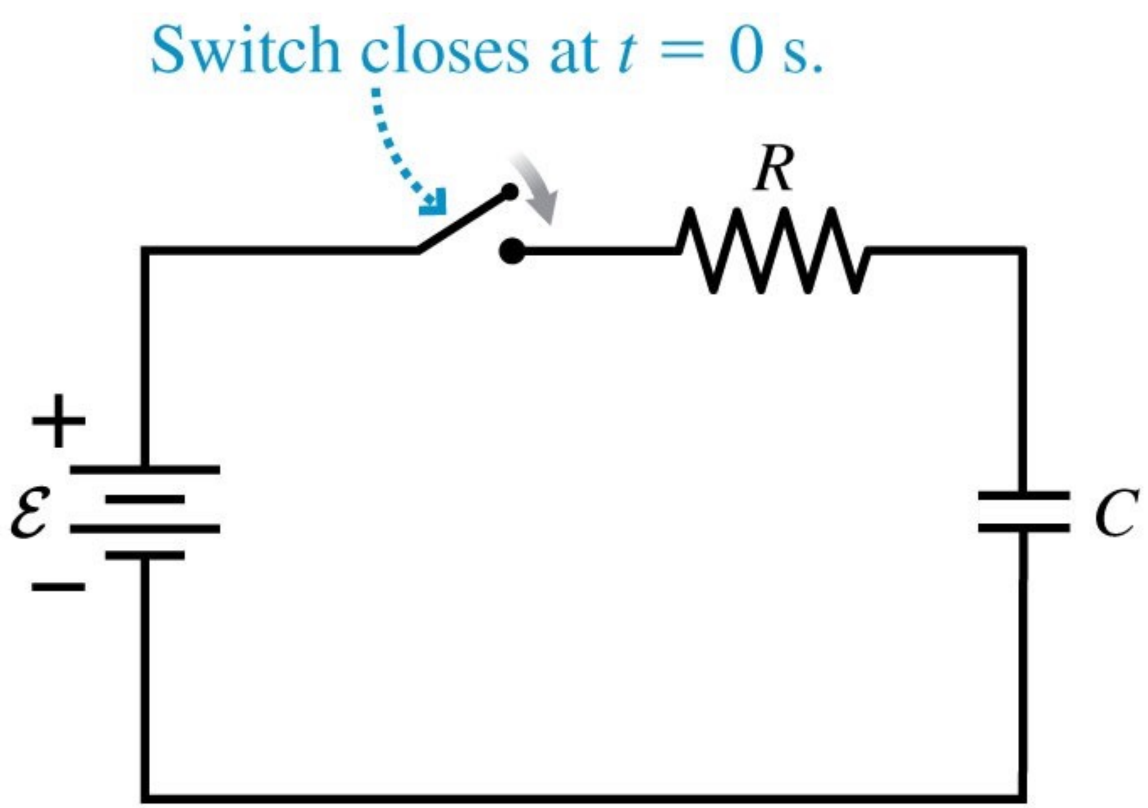
B. Somewhere between 0 V and 6 V.

C. 6 V.

D. Undefined.



Without looking in your book, draw the Q vs. t curve for the capacitor.



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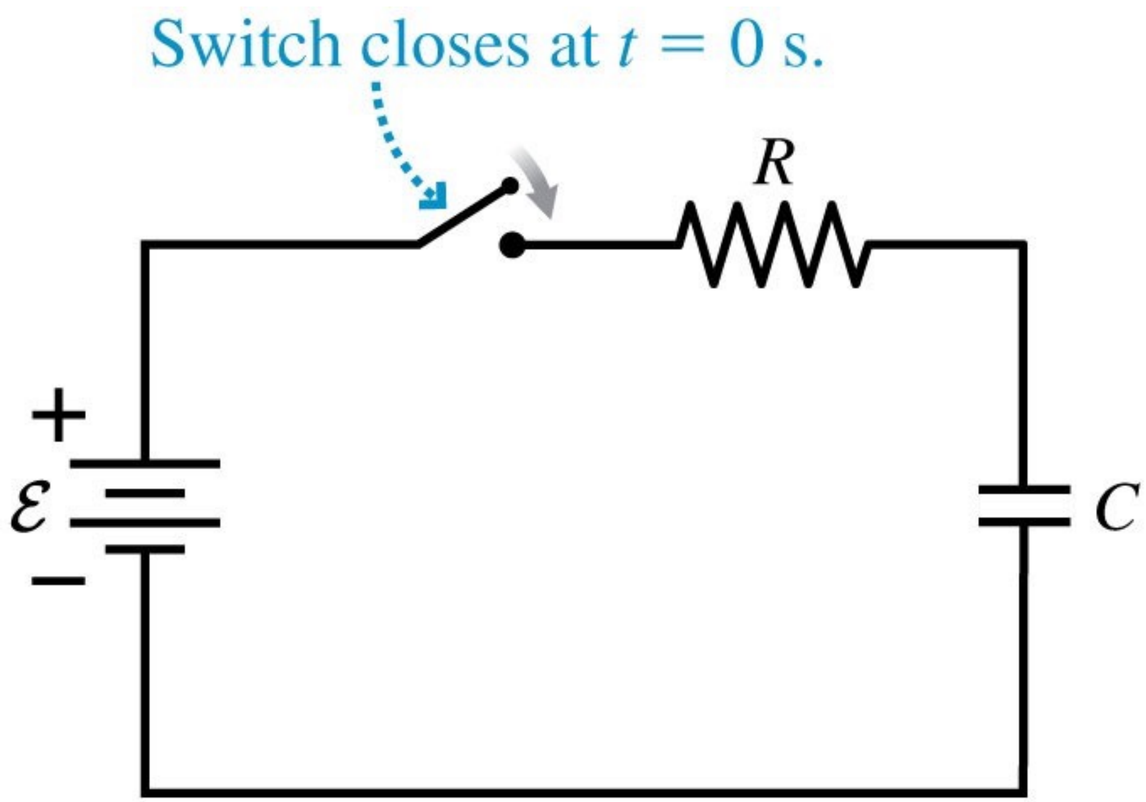

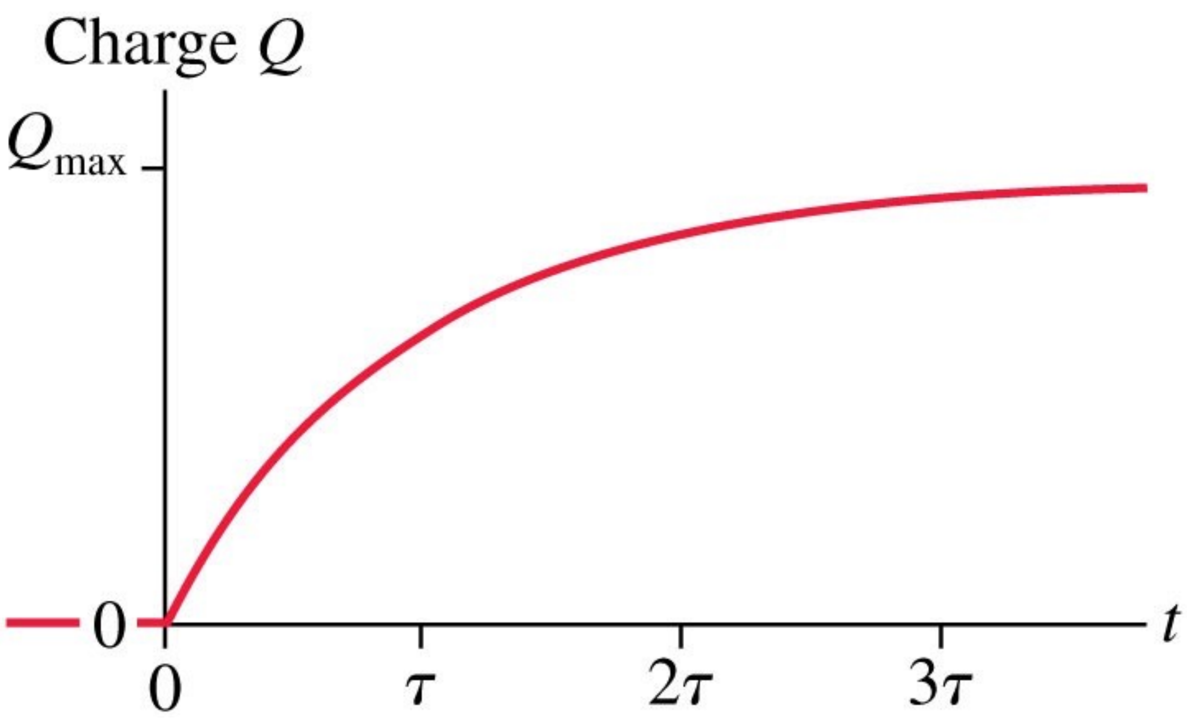

The Math

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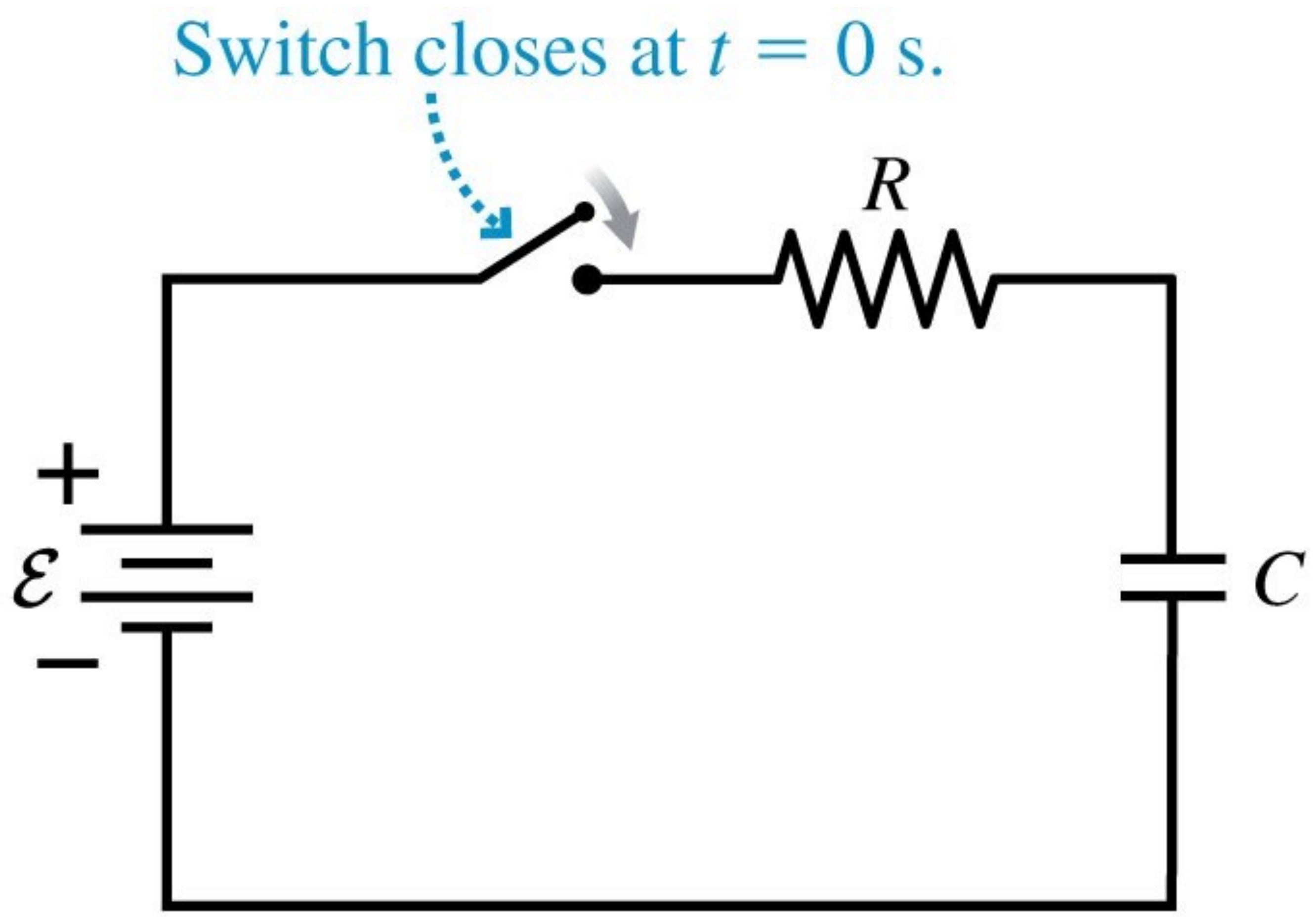
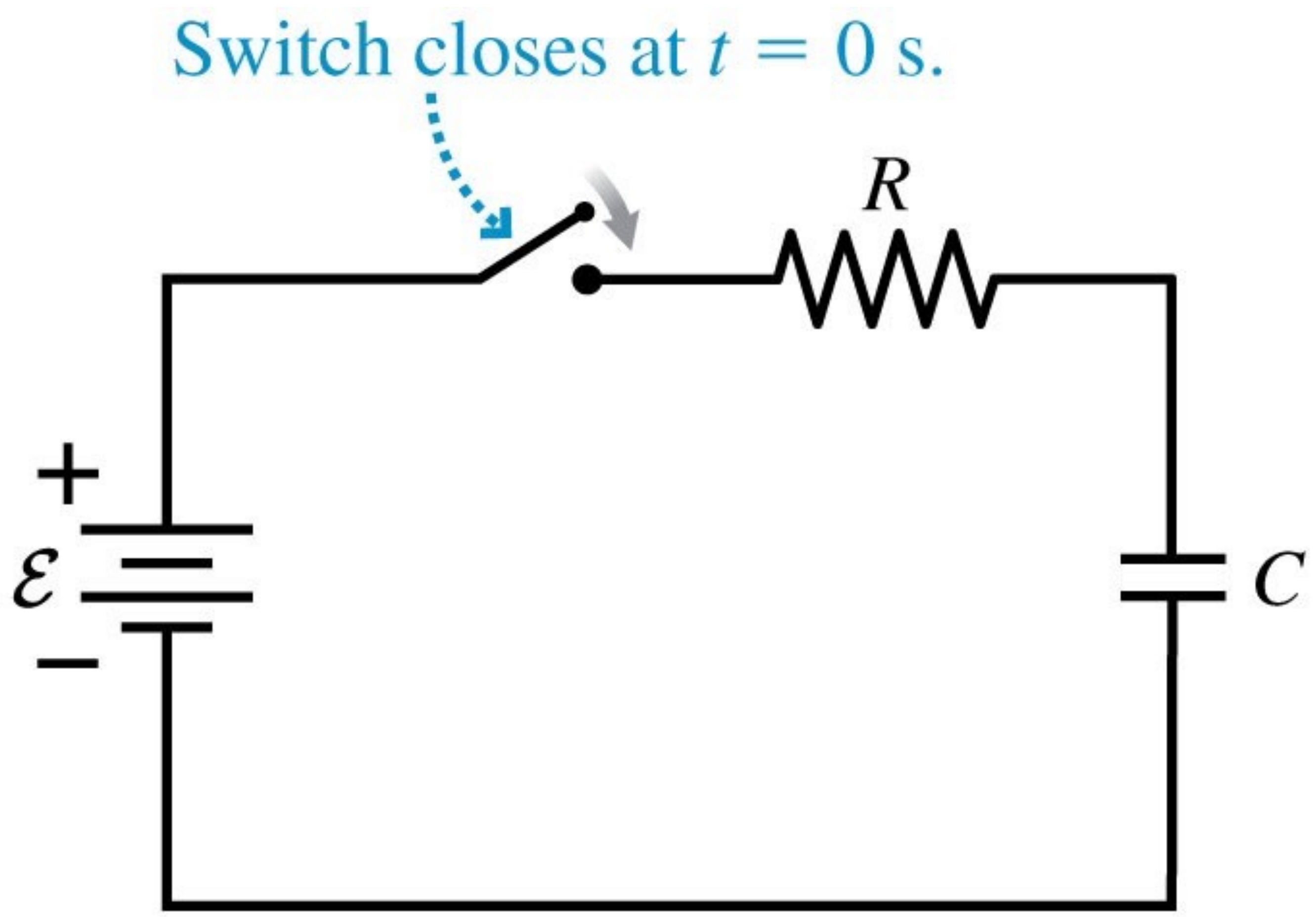


The Math

Write down Kirchoff's loop rule for this circuit

$$\epsilon - IR - \frac{q}{C} = 0$$



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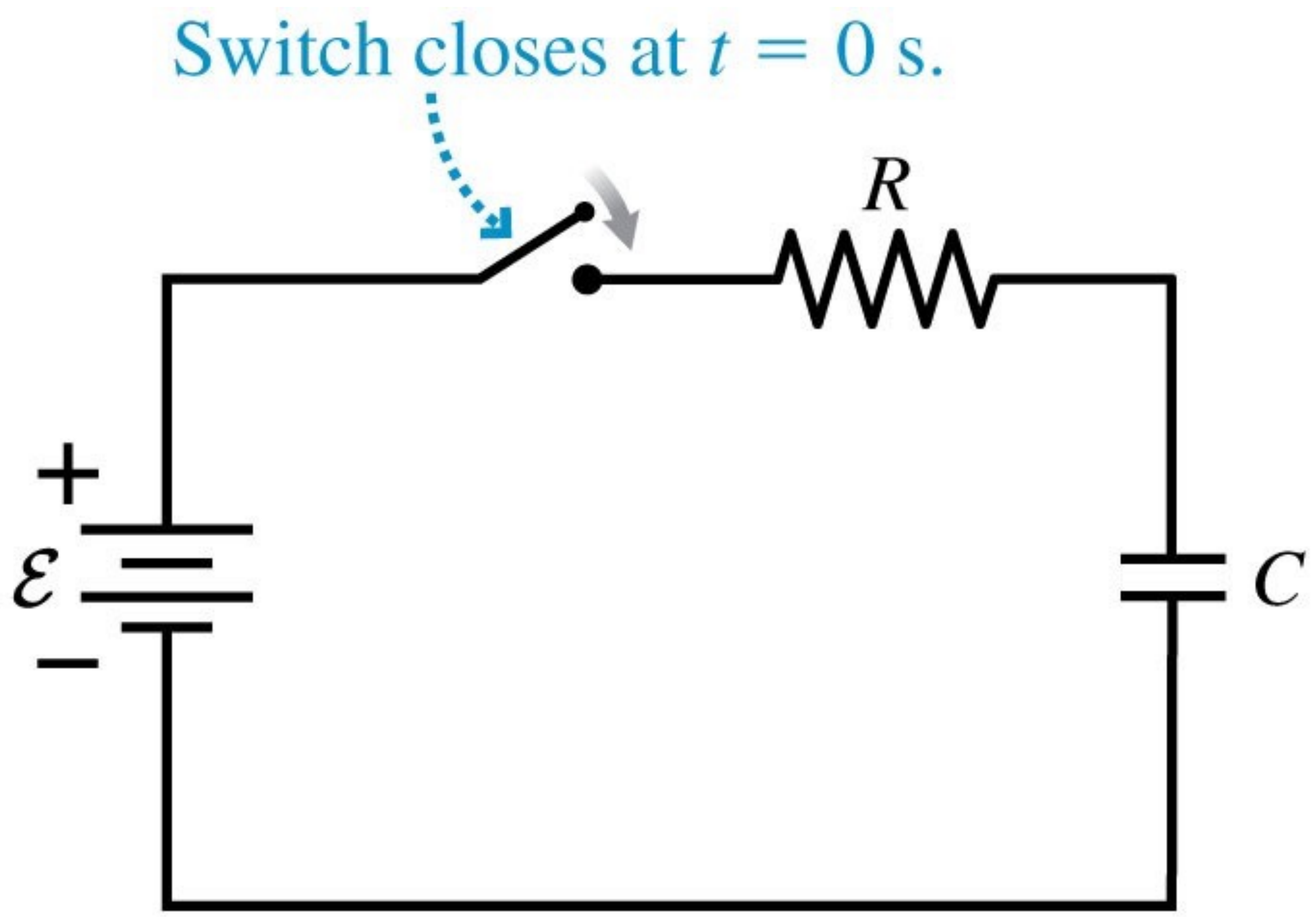

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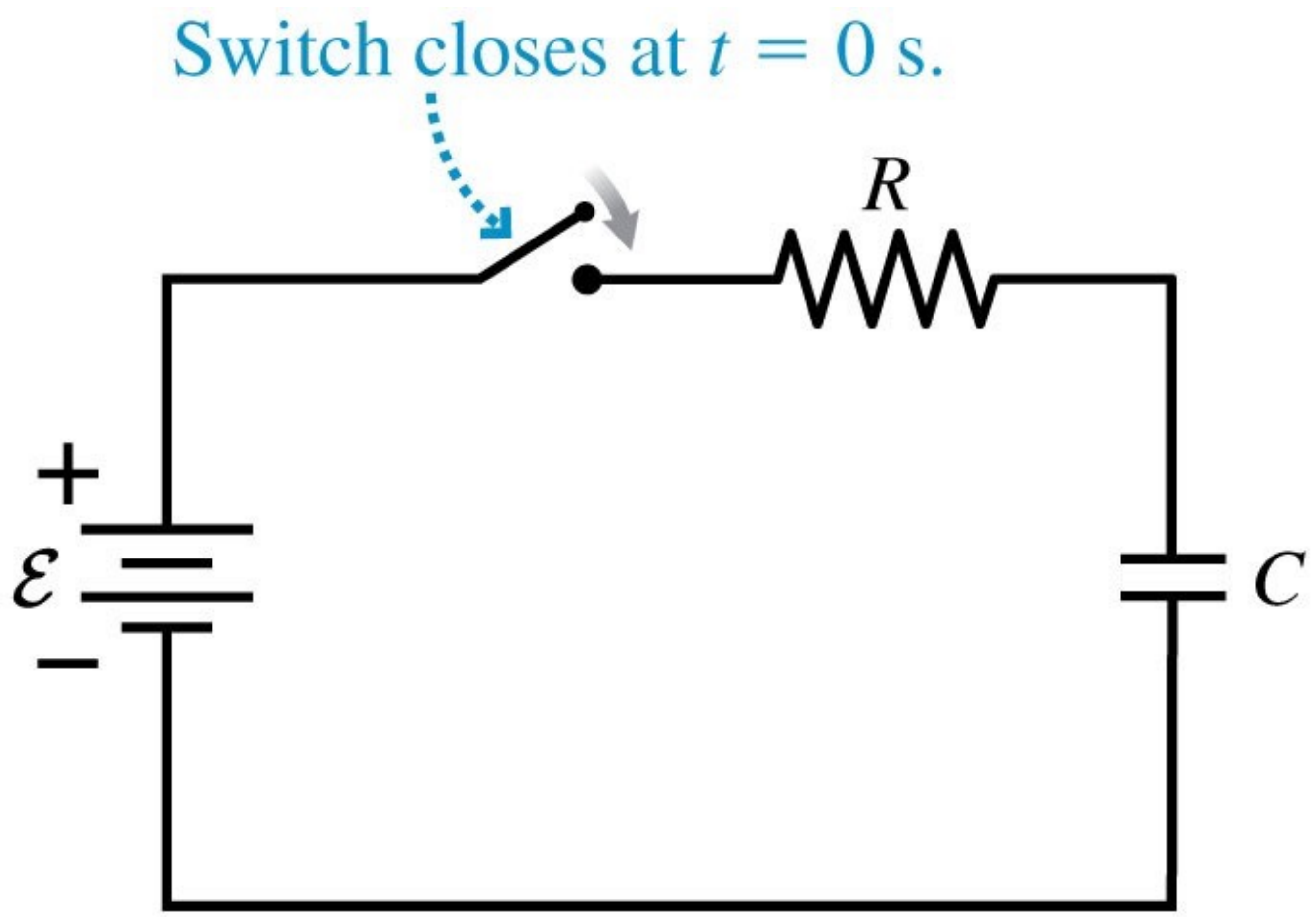

$$\epsilon - IR - \frac{q}{C} = 0$$

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$$\epsilon - \frac{dq}{dt}R - \frac{q}{C} = 0$$

The Math

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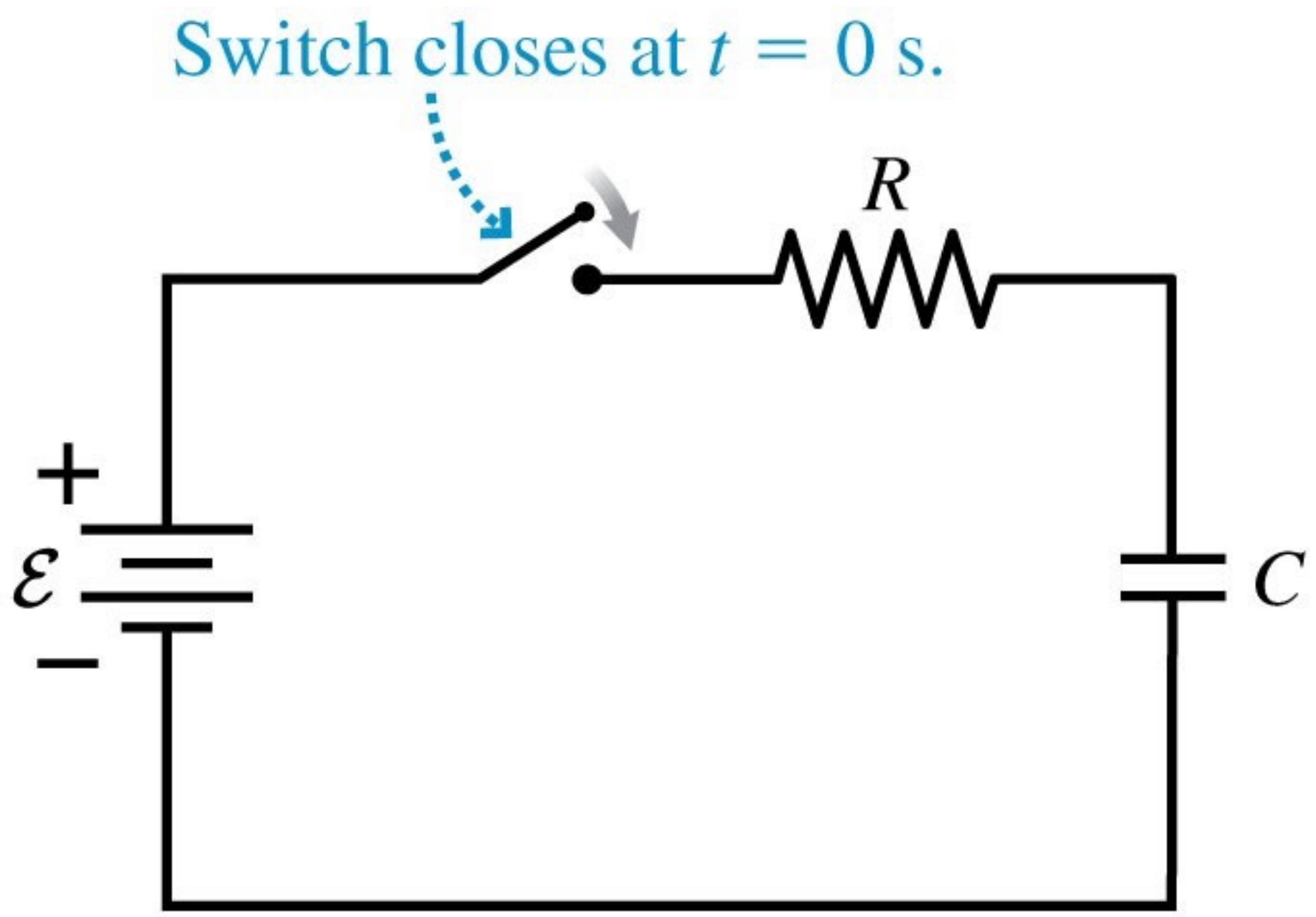

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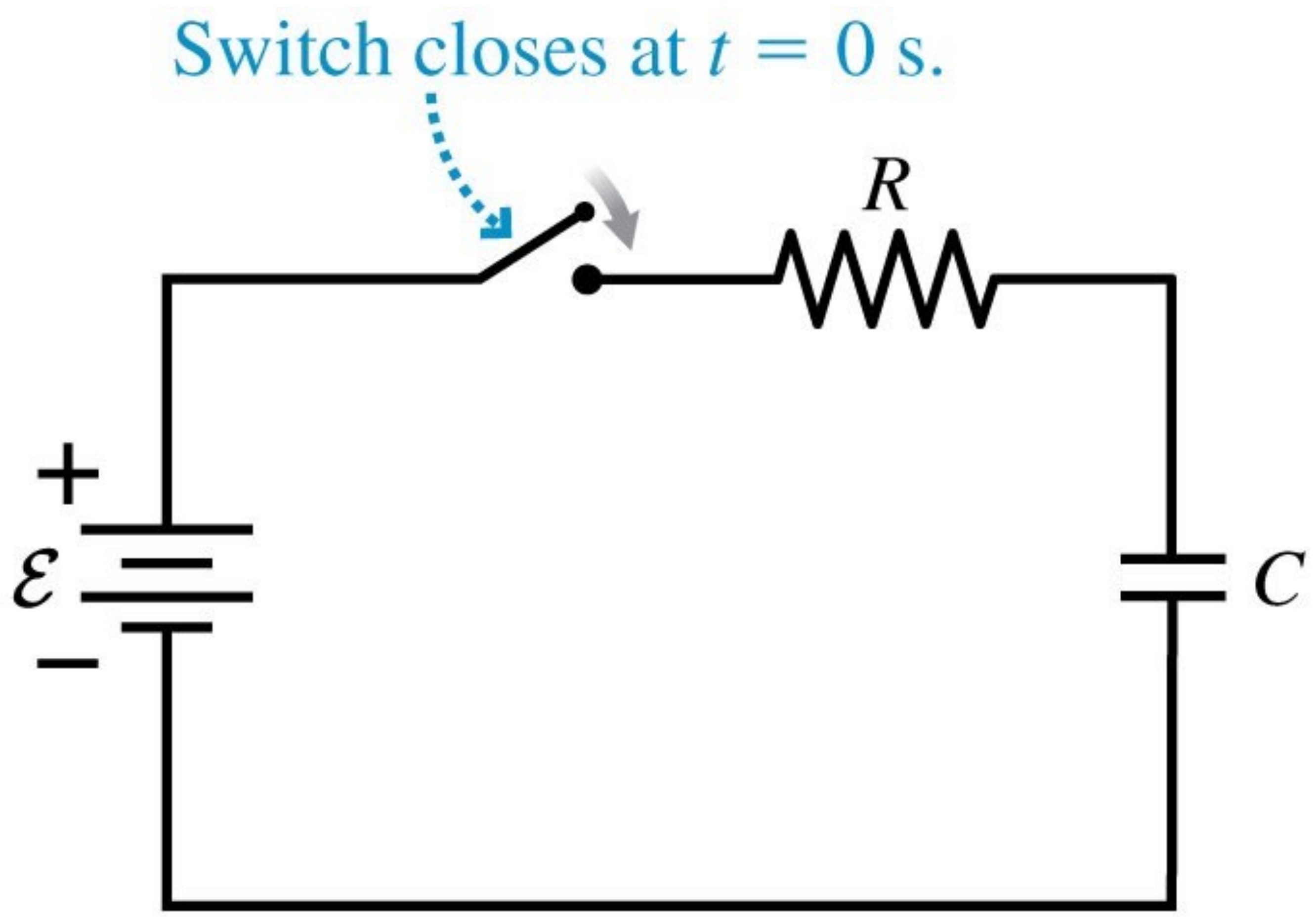

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$$\int_0^Q \frac{dq}{\epsilon c - q} = \int_0^t \frac{dt}{RC}$$

The Math

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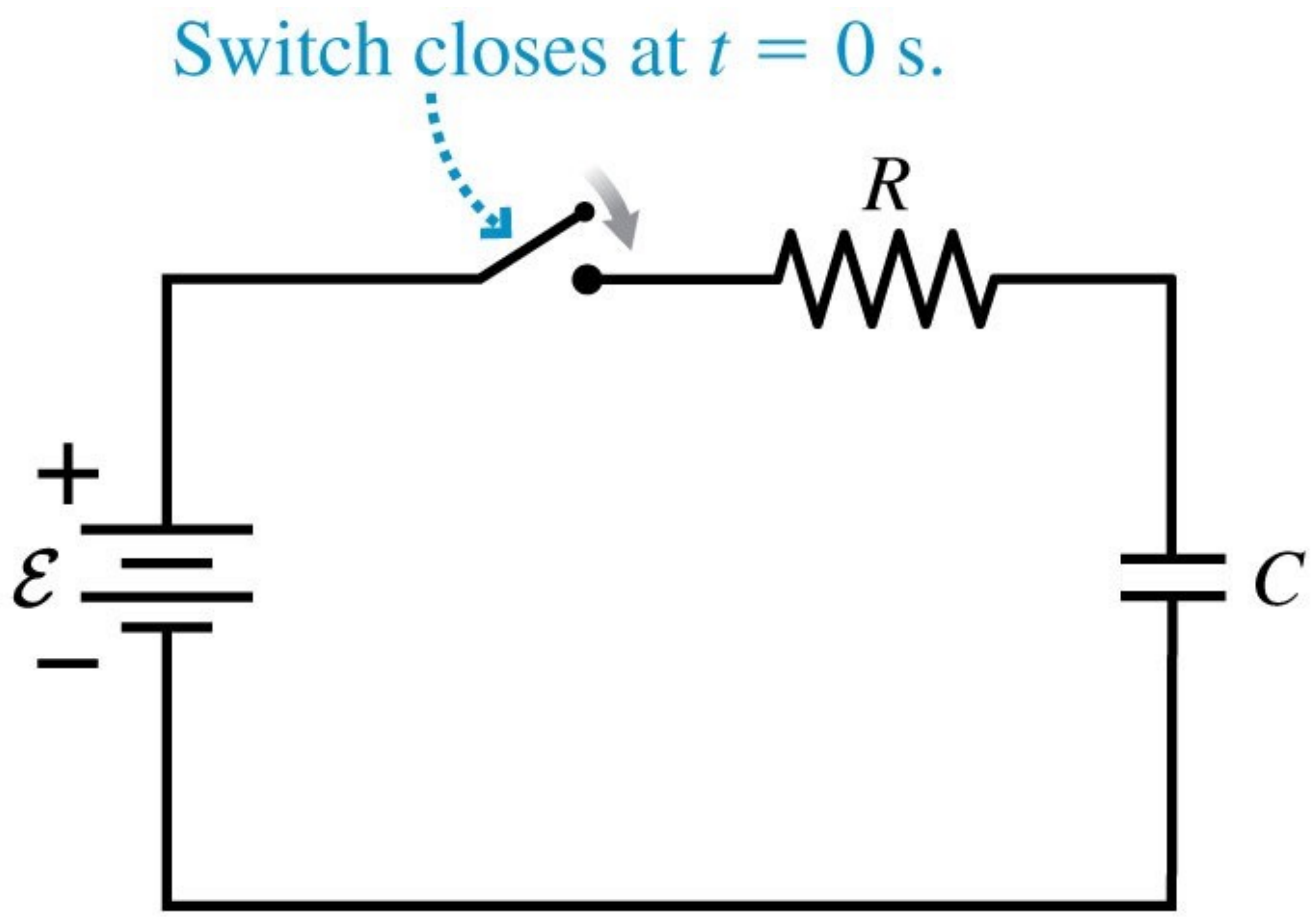

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$$\boxed{Q = Q_{\text{max}}(1 - e^{-t/\tau})}$$

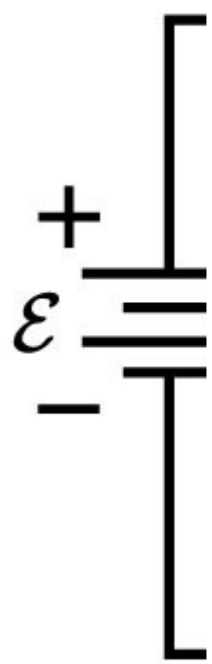
$$\tau = RC$$

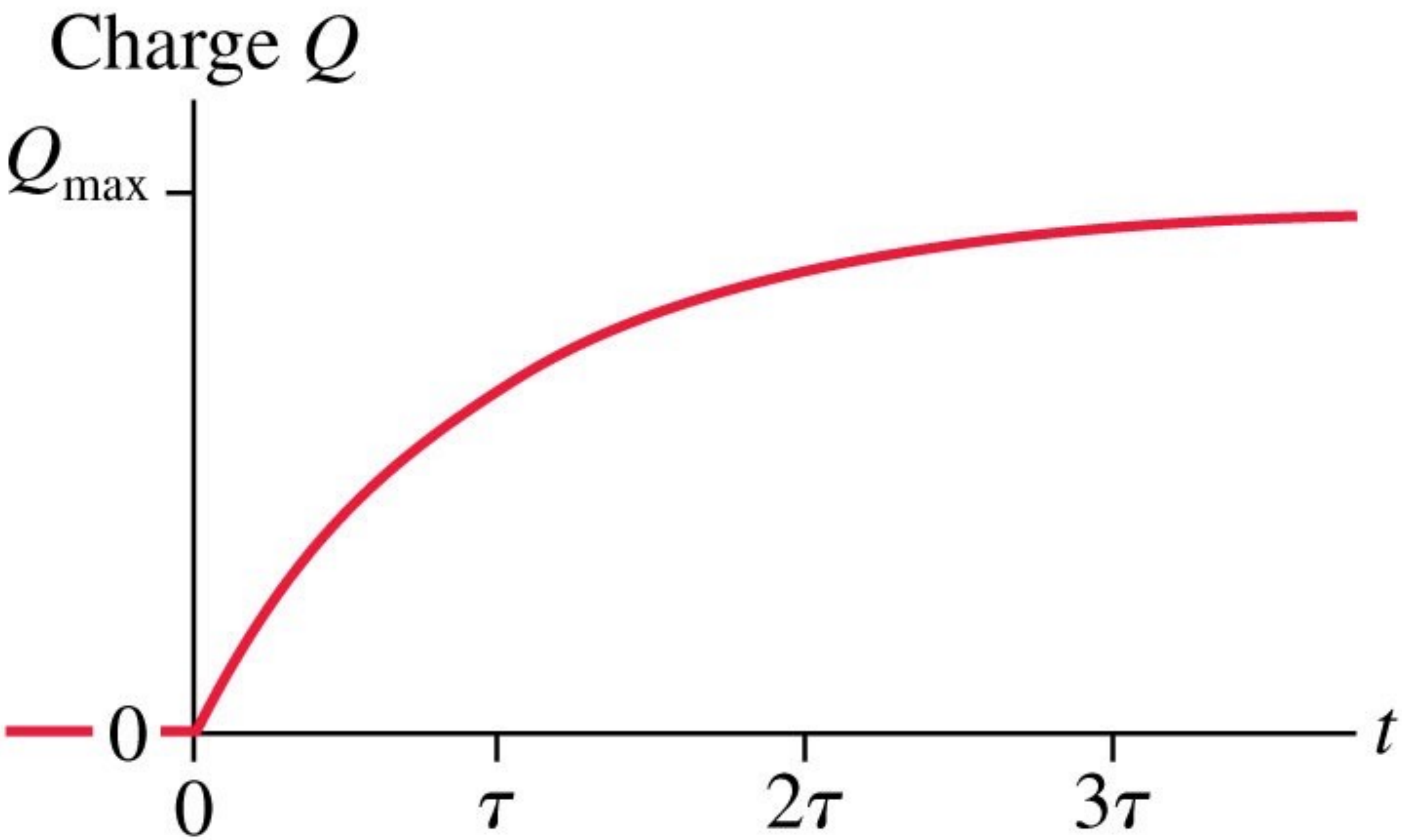
The Math

Write down Kirchoff's

$$\epsilon - IR - \frac{q}{C} = 0$$

S





$\frac{q}{C} = 0$

Q in
ide.
sides.

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$$\tau = RC$$

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