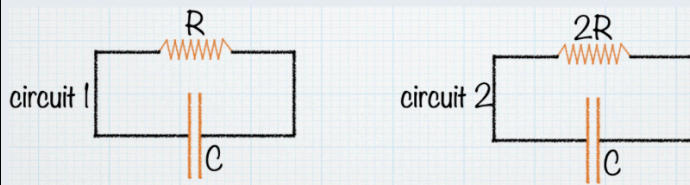


The two circuits shown contain identical fully charged capacitors at  $t = 0$ . Circuit 2 has twice as much resistance as circuit 1. Compare the charge on the two capacitors a short time after  $t = 0$ .

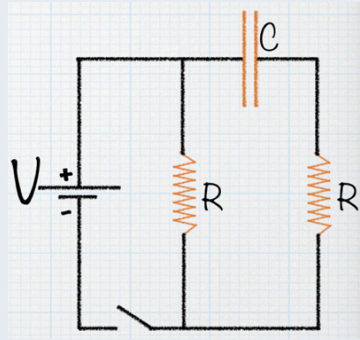


If you connect a fully-charged capacitor in series with a resistor and complete the circuit, the  $\Delta V$  of the charged capacitor will drive a current through the resistor. Simultaneously the capacitor will discharge. Basically, the charge coming off the capacitor is the current (flow of charge) through the resistor.

The resistor impedes the flow of charge. A bigger resistor will impede the current even more. Circuit 2 has more resistance than circuit 1 so the  $2R$  resistor will impede the flow of charge coming off the capacitor twice as much as the resistor in circuit 1. This will cause the capacitor in circuit 2 to discharge slower than circuit 1.

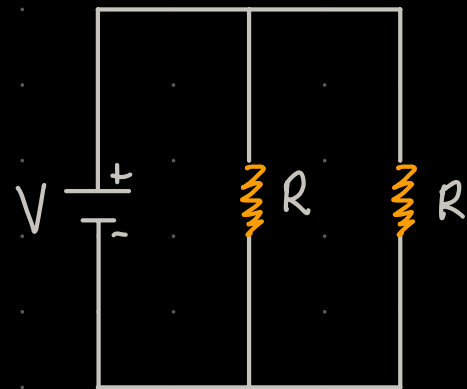
After a short time the capacitors will both have less charge but capacitor 2 will lose charge slower so it will have more charge on it when you compare it to capacitor 1 at the same time.

Consider the circuit shown in the figure and assume the battery has no internal resistance.



Just after the switch is closed, what is the current that flows through the battery?

When the capacitor is uncharged, it has no potential difference across it ( $\Delta V_c = 0$ ) and it will behave like a wire. So, just after the switch is closed, the capacitor has not had time to collect charge yet. At this instant, with  $\Delta V_c = 0$ , the circuit looks like:

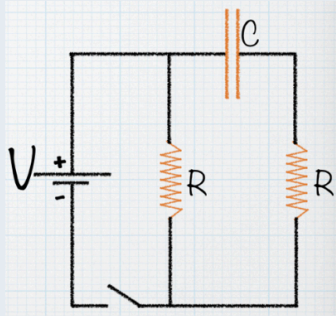


To find the current through the battery, we can simplify the circuit. The resistors are connected in parallel so the total resistance is:

$$\frac{1}{R_{\text{tot}}} = \frac{1}{R} + \frac{1}{R} = \frac{2}{R} \Rightarrow R_{\text{tot}} = \frac{R}{2}$$

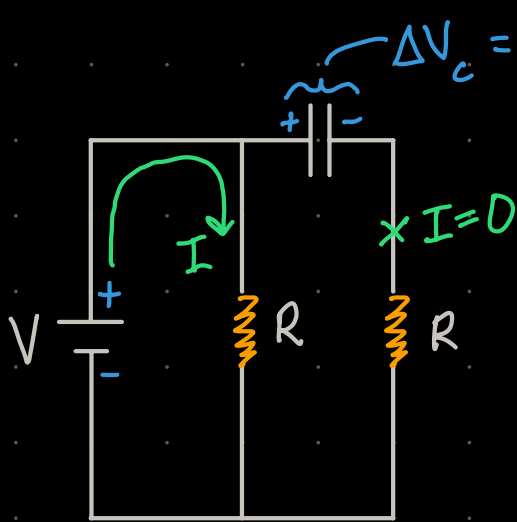
$$\text{Then the current is } I = \frac{\Delta V}{R} = \frac{V}{R/2} = 2 \frac{V}{R}$$

Consider the circuit shown in the figure and assume the battery has no internal resistance.



A very long time after the switch has been closed, what is the current that flows through the battery?

"A very long time" means the capacitor had enough time to fully charge. When the capacitor is fully charged, its potential difference is equal to the emf of the battery that charged it.



The charged capacitor will prevent current from flowing through that branch of the circuit. So after a long time, the circuit only has current flowing through one resistor and this current also flows through the battery.

$$I = \frac{\Delta V}{R} = \frac{V}{R}$$