

I3 Discharge of a Capacitor

16/20

Complete the questions in the table:

	Capacitance	Resistance	Time constant	Halving time
I3.1	100 μF	200 $\text{k}\Omega$	(a)	(b)
I3.2	2200 μF	(a)	45 s	(b)
I3.3	(a)	330 Ω	(b)	0.10 s
I3.4	10 μF	(a)	3.0 minutes	(b)

- I3.5 Draw the circuit diagram for a circuit which could discharge a capacitor through a fixed resistor while measuring the discharge current and voltage across the capacitor.
- I3.6 A 2200 μF capacitor is charged with a 12 V battery. It is then discharged through a 10 $\text{k}\Omega$ resistor.
- What is the initial discharge current?
 - Calculate how long the capacitor would take to discharge if the initial rate of discharge were maintained.
 - What will the voltage be across the capacitor after 22 s?
 - What will the current be when the voltage across the capacitor has halved?
 - How much time will it take before the capacitor has a voltage of 3.0 V across it?
- I3.7 A 5.0 μF capacitor is charged with a 20 V supply. It is then discharged through a 10 $\text{k}\Omega$ resistor.
- Calculate the time taken for the voltage across the capacitor to halve.
 - Calculate the voltage across the capacitor two time constants after the discharging starts.
 - Calculate the charge on the capacitor after one time constant.

- d) Calculate the current flowing in the circuit 0.20 ms after the discharging starts.
- 13.8 If you want to make a timing circuit where a capacitor's voltage reduces from 12 V to 4.0 V over 3.0 minutes using a 1000 μF capacitor, what value of resistance do you need?
- 13.9 A 500 μF capacitor is initially uncharged. It is connected to a 12 V battery in series with a 20 k Ω resistor. Work out the voltage across the resistor after 8.0 s.