I3 Discharge of a Capacitor

16/20

Complete the questions in the table:

	Capacitance	Resistance	Time constant	Halving time
I3.1	100 μF	200 kΩ	(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 kΩ resistor.

a) What is the initial discharge current?

b) Calculate how long the capacitor would take to discharge if the initial rate of discharge were maintained.

c) What will the voltage be across the capacitor after 22 s?

d) What will the current be when the voltage across the capacitor has halved?

e) 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 kΩ resistor.

a) Calculate the time taken for the voltage across the capacitor to halve.

b) Calculate the voltage across the capacitor two time constants after the discharging starts.

c) 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.

I3.8 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?

I3.9 A 500 μF capacitor is initially uncharged. It is connected to a 12 V battery in series with a 20 kΩ resistor. Work out the voltage across the resistor after 8.0 s.