



Objectives

1. The student will investigate charging and discharging process through capacitors.
2. The student will investigate the effect of adding a resistor in series with a capacitor (RC Circuits).

Apparatus

- Experiments Board (Simple-2)
- Resistor 330Ω
- Jumpers
- 2xAA Battery Holder w/AA batteries
- LED
- Capacitor $470\ \mu\text{F}$
- Switch

Procedure & Conclusions

1. Build a simple circuit consists of 3V battery connected at the pair (D) in a way that the positive side (red wire) will be towards the point (4), Capacitor $470\ \mu\text{F}$ at the pair (A) in a way that its positive terminal will be towards point (2), resistor 330Ω at the pair (B) and a switch at the pair (C), as shown in the photo.
2. Set the mode of the DMM to (DVC) (range 20), insert its probes at the points (1) & (2)
3. Press the switch button continuously for few seconds while watching the charging

process through the DMM reading, when the reading reaches the applied voltage (3V) then the capacitor is fully charged, and hence the Voltmeter reading becomes still.

- The positive terminal of the capacitor should be connected to the ... **positive / negative ...** terminal of the voltage source., otherwise the capacitor might be destroyed.
 - By closing the circuit, the voltage across the terminals of the capacitor increases to maximum (equals the applied voltage) ... **gradually / instantly ...**, this process is called ... **charging / discharging ...** of a capacitor.
4. Insert a LED at the the pair (D) instead of the battery in a way that the positive terminal of the LED will be towards the point (4).
 5. Press the switch button continuously for few seconds and see if the LED emits light, and watch the capacitor discharging time through the Voltmeter reading (in this case the capacitor still has some charge which can be predicted from the Voltmeter reading since it doesn't go to zero).
 - When you press the switch button, the LED ... **emits / doesn't emit ...** light, the voltage source in this circuit is the ... **battery / capacitor ...**
 - In this step, the voltage across the terminals of the capacitor ... **decreases / increases / remains the same ...**
 6. Insert a jumper at the pair (D) instead of the LED.
 7. Press the switch button continuously for few seconds and watch the change in the

Voltmeter reading.

- In the above step, the Voltmeter reading equals, this indicates that the capacitor is fully ... **charged / discharged ...**, this process is called ... **charging / discharging ...** of a capacitor

Note: Capacitor can be fully discharged by touching the capacitor's external leads together.

8. Connect again a 3V battery at the pair (D) in a way that the positive side (red wire) will be towards the point (4), and insert a jumper at the pair (B) instead of the resistor.
9. Press the switch button continuously for few seconds and notice the time required to charge the capacitor through the DMM reading, compare this result with what you got in step 3
 - By using a jumper Ω instead of the resistor 330Ω , the capacitor charging time ... **increases / decreases** We conclude that when we increase the value of the resistor connected in series with a capacitor, the capacitor charging time ... **increases / decreases ...**
10. Repeat Steps 4 & 5
 - By using a jumper instead of the resistor, the capacitor discharging time ... **increases / decreases** We conclude that as the value of the resistor connected in series with a capacitor increases, the capacitor discharging time ... **increases / decreases ...**