Final Charge on a Capacitor

Recorder	Manager
Skeptic	Energizer

1 Charging and discharging capacitors

Two batteries, connecting wires, round bulb, long bulb, socket, capacitor, stopwatch.

In each case, record your observations, then repeat them and time the phenomenon.

Make sure the capacitor is uncharged before charging: connect a wire across it for several seconds									
1.1 <i>Discharge</i> . Then connect	What do you obs	erve?	How long does this last?						
the capacitor in series with a									
ROUND bulb and two batteries.	ROUND bulb and two batteries.								
(Fig 1.1)									
1.2 Remove the batteries and	What do you obs	erve?	How long does this last?						
connect the ROUND bulb	lb								
directly to the capacitor.									
(Fig 1.2)									
1.3 <i>Discharge</i> . Then connect	What do you obs	erve?	How long does this last?						
the capacitor in series with a									
LONG bulb and two batteries.									
1.4 Remove the batteries and	What do you obs	erve?	How long does this last?						
connect the LONG bulb									
directly to the capacitor.									
Figure 1.1 Circuit for charging a ca	pacitor	Figure 1.2 Circuit for discharging a capacitor							
Capaci	tor								
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2 THE EFFECT OF DIFFERENT BULBS ON THE FINAL CHARGE ON A CAPACITOR

In this portion of the lab you will:

- Formulate and clearly state a hypothesis
- Perform an experiment to test your hypothesis
- Draw a conclusion regarding your hypothesis, taking into account the error of your measurements Equipment: Two batteries, round bulb, long bulb, capacitor, connecting wires. You may also need other equipment, such as a stopwatch or a compass.

2.1 HYPOTHESIS:

- On the previous page you observed different behavior (time, brightness) when charging a capacitor through a long bulb vs. through a round bulb.
- In which situation (long bulb vs. round bulb) do you think more charge accumulates on the plates of the capacitor? Formulate a hypothesis about this, and state it clearly.
- It is ok if your hypothesis turns out to be incorrect that's what experiments are for! However, it must be clearly stated, and you must give at least one reason you think it may be correct.

HYPOTHESIS and reason:

2.2 PLANNING AN EXPERIMENT: On the next page you will perform the following experiment to test your hypothesis (if you have a different or better idea for an experiment, discuss this with your instructor):

Charge capacitor through ROUND bulb, then \Rightarrow	Discharge capacitor through ROUND bulb Time how long the bulb stays lit
Charge capacitor through LONG bulb, then \Rightarrow	Discharge capacitor through ROUND bulb Time how long the bulb stays lit

Think about how performing this experiment would allow you to determine if your hypothesis is correct or not. If your hypothesis is correct, what should you observe? Should the effects be large or small?

If your hypothesis is incorrect, what should you observe? Should the effects be large or small?

Check with a neighboring group, then both groups check with instructor. Do you have a hypothesis, reason, and predictions? **2.3 EXPERIMENTAL DATA:** Clearly report your measured data here, in a table. Repeat all measurements 4 times. In the table, show all measured values, average value for each condition, and either maximum deviation or standard deviation, for each value.

- Make sure the capacitor is uncharged before charging: connect a wire across it for several seconds.
- *Always have the same person determine when the bulb stops glowing*, since different people may decide differently, which can introduce an additional and undesirable source of variation.

Discharge capacitor. Charge with ROUND Discharge with ROUND	Discharge time 1	Discharge time 2	Discharge time 3	Discharge time 4	Average dis- charge time	Maximum deviation
Discharge capacitor. Charge with LONG Discharge with ROUND	Discharge time 1	Discharge time 2	Discharge time 3	Discharge time 4	Average dis- charge time	Maximum deviation

3.4 ANALYSIS AND CONCLUSIONS



CONCLUSION: Explain clearly and rigorously (do not leave out steps in reasoning) whether your results confirm or contradict your hypothesis. **Do not change your hypothesis!** Are the size of the effects consistent with the nature of your hypothesis?