Capacitor Lab 1

Equipment: One Genecon generator; one 25 000 μF (0.025 F) capacitor; one 100 000 μF (0.1 F) capacitor; one 1 F 'supercap' capacitor, four clip leads, one #14 light bulb and holder.

Warning: The #14 round light bulbs are rated at 2.5 volts. Their lifetime shortens considerably when run at a slightly higher voltage. The Genecons will put out 2.5 volts if they are turned at 60 rev/min. Do not turn them faster than that when connected to the #14 bulbs or when attached to the capacitors. (If you turn them faster, you will charge the capacitor to over 2.5 volts. When you attach the bulb, the higher voltage on the cap will burn out the bulb. You are still guilty!) If you burn one out, you will be charged $1.00. If you have a lot of money, don't be a moron and just burn them out for fun. We only have a limited number of bulbs.

Part A - **********

1. Make sure the Genecon plug is attached with the copper wire at the top and the silver colored wire at the bottom. The copper wire is + and the silver colored wire is –. Remember this.

2. Attach the + alligator clip to the + terminal of the large silver colored 0.1 μF cap. Connect the – clip to the – terminal. Turn the crank at no more than 60 rev/min for about 20 seconds. Notice what it feels like as you turn the crank. Now let go of the crank at 20 seconds. Time how long it takes for the crank to stop. Record the time.

3. Do the same for the smaller blue 0.025 μF cap. Record the time.

4. Do the same for the small green 1 F supercap. The – terminal has two black lines on the side of the cap. Record the time. Compare the times in steps 2, 3, and 4.

Part B - **********

5. Now charge the silver 0.1 μF cap for 20 seconds again using 60 rev/min. While turning, one lab partner should disconnect one alligator clip from the cap. Notice what how the crank feels when the cap is suddenly disconnected. Then disconnect the other alligator clip.

6. Attach an alligator clip lead to each terminal of the bulb holder. Then attach the other ends to the + and – terminals of the cap. It doesn't matter which you connect to. Time how long the filament stays lit. As it goes out, it will be a very faint orange/red color. Record the time.

7. Do 5 and 6 again for the blue 0.025 mF cap. Record the time. You have to look quickly since the bulb never really gets bright. You may need to put the bulb inside cupped hands to see it.

8. Do 5 and 6 again for the green 1 F supercap. Record the time.

Part C - **********

9. Now trade caps with another group so you have either two blue caps or two silver caps.

10. First connect them in parallel using clip leads. This means connect + to + and – to –. Now connect the + clip of the Genecon to one of the + cap terminals and the – to one of the – cap terminals.

11. Repeat steps 5 and 6 and record the time. Compare this to what you got for this size cap the last time.

12. Now connect the caps in series. This means connect one of the + cap terminals to the – terminal of the other cap. Then connect the free + terminal to the + Genecon clip and the free – terminal to the – Genecon clip.

13. Repeat steps 5 and 6 and record the time. Compare this to what you got for this size cap the last time.

14. If you have time, you may do the same with two supercaps. Combine two lab groups for this.

Part D - **********

15. Now switch caps again so you have the other size. Repeat steps 10 to 13, recording times as you go.

Part E - **********

16. Attach the Genecon, the 1 F cap, and the #14 bulb in series. This means connect the positive of the generator to the positive of the cap, then to the bulb, then the negative of the generator to the other end of the bulb.

17. Turn the generator at 60 rev/min for about 20 seconds and watch the brightness of the bulb. Don't change the cranking speed. What happens? Why?

Part F - **********

18. **What did you learn? –>** (a) How does the total charge stored in two caps in parallel compare to the charge stored in one cap? (b) How does the total charge stored in two caps in series compare to the charge stored in one cap? (c) Does this make sense compared to what you saw in the Electronics Workbench simulation? (d) Why does the light bulb in part E get dim after a while?