Submission Form

Fill up the following slots with appropriate content. You must submit the content of this document from this page only.

- Your Name : TASNIM RAHMAN MOUMITA
- Your ID: 22301689
- Your Section : 02
- Experiment No: 02
- Experiment Title: Determination of the time constant of an RC series circuit

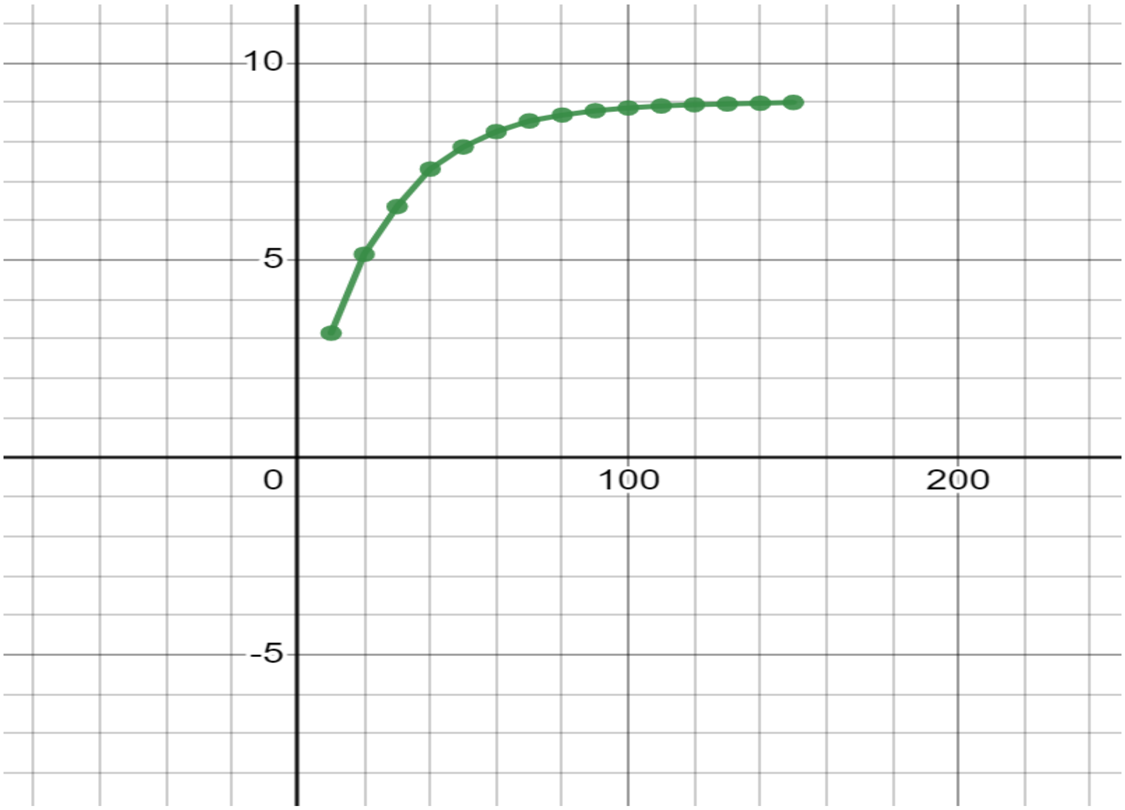
Table: Data showing the time dependence of voltage across the capacitor

Observation	Time, t (s)	Voltage across the capacitor, Vc During charging process (V)	Voltage across the capacitor, Vc During discharging process (V)	Time constant, (t)
01	10	3.15	5.70	According to theory, the time constant is the amount of time needed for the circuit to gain 63% of its maximum voltage during charging or to lose 37% of its maximum voltage during discharging. For charging , 63% of maximum voltage is 5.67 V and for discharging 37% of maximum voltage is 3.33 V. The required time for the 63% of maximum voltage is 24.3 s and for 37% of the maximum voltage is 24.13s. Their average value is 24.2s. So, this is the experimental value of time constant , which is 24.2.
02	20	5.15	3.93	
03	30	6.36	2.48	
04	40	7.31	1.71	
05	50	7.87	1.13	
06	60	8.26	0.74	
07	70	8.53	0.47	
08	80	8.68	0.32	
09	90	8.79	0.21	
10	100	8.86	0.13	
11	110	8.91	0.09	
12	120	8.94	0.06	
13	130	8.96	0.04	
14	140	8.98	0.03	
15	150	9.0	0.019	
16	160		0.011	
17	170		0.008	
18	180		0.005	
19	190		0.004	

20 21 22 23 24 25	200 210 220 230 240 250		0.002 0.002 0.001 0.001 0.001 0.0	Now, we know that the value of time constant – t = RC = 120 * 0.2 = 24s This is the theoretically predicted and expected value. So we got our experimental value 24.2 and theoretically predicted value 24. So in comparison , the experimental value is 0.2 s more than the theoretically predicted one .

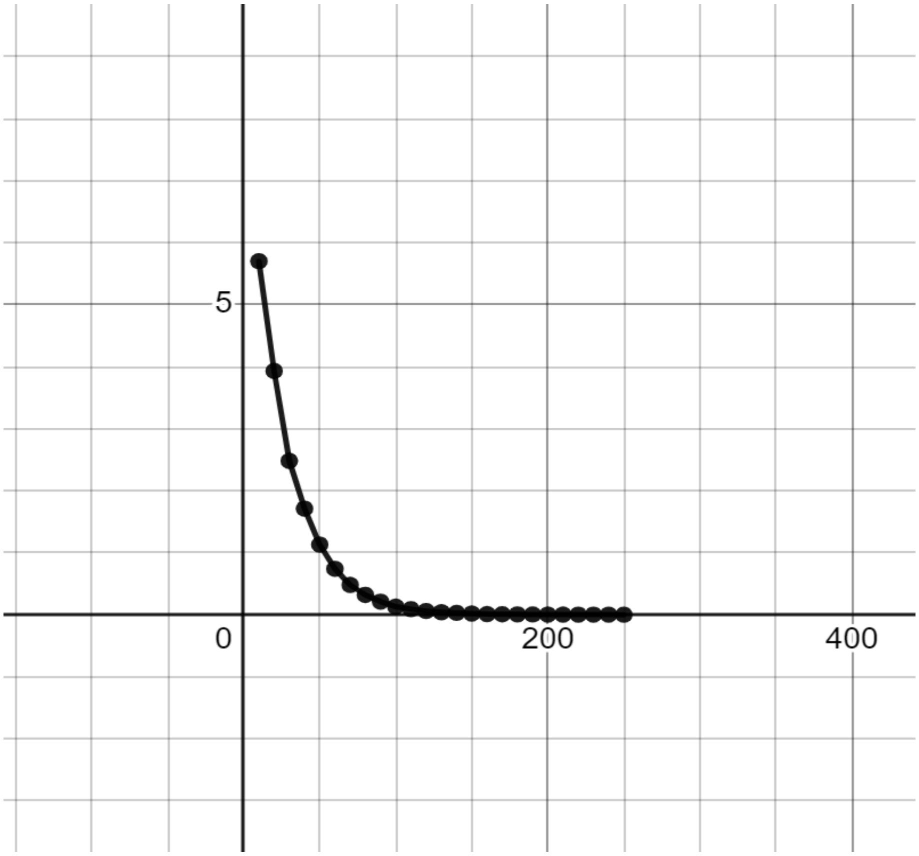
Capacitance, C = .2F
Resistance, R=120 Ohm

Graph 1: Insert the Graph here



<u>Graph-1 : </u>Time(t) vs Voltage across the capacitor, Vc During charging process (V)

Graph 2: Insert the Graph here



Graph-2: **Time(t) vs Voltage across the capacitor, Vc During discharging process (V)**

Calculations:

In our theoretical discussion, we learned that the time constant of a circuit is the time it takes for the circuit to reach 63% of its maximum voltage during charging, or to drop to 37% of its maximum voltage during discharging. In our experiment, we found that 63% of the maximum voltage was 5.67 V during charging, and 37% of the maximum voltage was 3.33 V during discharging. The circuit took 24.3

seconds to reach 5.67 V during charging and 24.13 seconds to drop to 3.33 V during discharging. Averaging these two times, we found the experimental value of the time constant to be 24.2 seconds. This hands-on experiment gave us a practical understanding of the time constant in a circuit.

Here,
we know that the value of time constant –

t = RC = 120 * 0.2 = 24 s

So, This is the theoretically predicted/expected value.

Results:

So, as far this, we got our experimental value 24.2 and theoretically predicted value 24. So in comparison , (24.2-24 = 0.2) the experimental value is 0.2 s more than the theoretically predicted one.

My experimental value of the time constant is deviated from its theoretically predicted value is,

Deviation = ((24.2-24)/24) *100
= (.2/24) *100
= 0.833%

0.8333 % is the deviation.

Answer the following questions :

1. What will happen if you keep both K1 and K2 closed?

 Answer:

 If I keep both K1 and K2 closed, it will form a short circuit and catch fire.

2. Why do you think the Voltmeter was not connected in series?

 Answer:

When a component with high resistance is connected in series in a circuit, it can prevent current from flowing due to its high resistance. That's why we connect it in series. This setup allows us to control the current flow in the circuit effectively.

3. Why do you think we chose the maximum value of the resistance in the resistor?

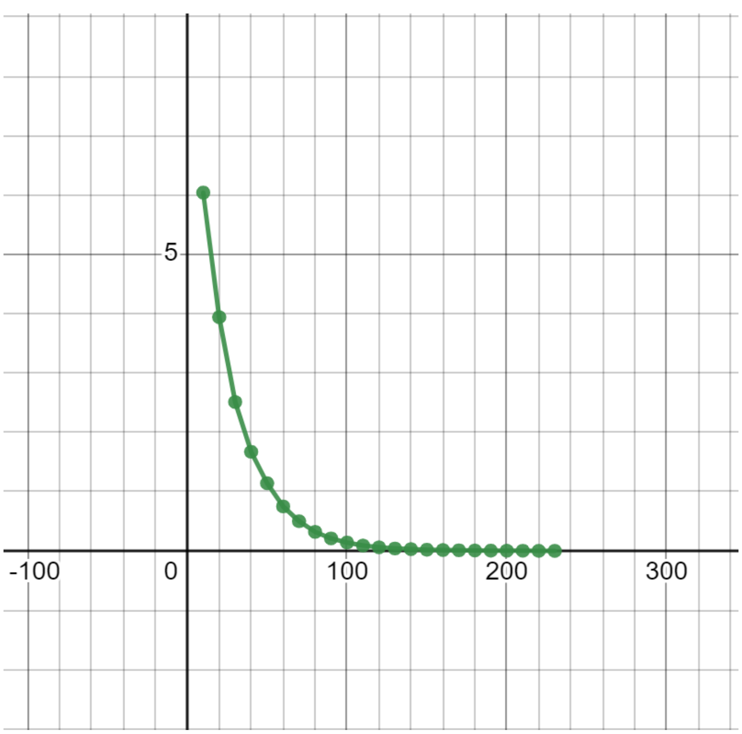
 Answer:

 When we use a resistor with a lower resistance in a circuit that includes a capacitor, the capacitor charges and discharges at a faster rate. This rapid ups and downs in the rate of charging and discharging can make it challenging to point the exact voltage across the capacitor. However, if we increase the resistance, the capacitor's charging and discharging process slows down, allowing us to obtain a more accurate voltage reading. This is likely why we chose to maximize the resistance of the resistor in such situations.

4. Sketch voltage across the resistor, V_R vs. time, t curve during charging and discharging process of the capacitor.

Answer:

During charging:



<u>During discharging:</u>