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Phys111 Report

Experiment #9: RC Circuit

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Section:	12		
Date:			

(1) Abstract:

- **Aim of the experiment:**

To find the value of an unknown capacitor through resistor of known value and through charging and discharging the capacitor.

- **The main results are:**

  - $\tau = 44 \pm 3\ sec$

(2) Data:

Charging				Discharging			
Time (sec.)	V_c (volts)	Time (sec.)	V_c (volts)	Time (sec.)	V_c (volts)	Time (sec.)	V_c (volts)
0	0.000	70	3.978	0	4.918	70	1.060
5	0.567	80	4.165	5	4.377	80	0.843
10	1.112	90	4.314	10	3.944	90	0.685
15	1.505	100	4.433	15	3.456	100	0.557
20	1.919	110	4.528	20	3.147	110	0.455
25	2.279	120	4.605	25	2.787	120	0.373
30	2.544	130	4.666	30	2.520	130	0.306
35	2.824	140	4.716	35	2.234	140	0.252
40	3.032	150	4.755	40	2.022	150	0.209
45	3.252	160	4.790	45	1.796	160	0.170
50	3.416	170	4.816	50	1.595	170	0.142
55	3.589	180	4.837	55	1.416	180	0.119
60	3.713	190	4.854	60	1.286	190	0.100
65	3.857	200	4.868	65	1.168	200	0.084

$R = (0.091 \pm 0.05) \times 10^6 \Omega$	$C_{manufacture} = 47\mu F$

(3)Calculations:

Charging/Discharging graph

$\tau_C = 44\ sec$	$\tau_D = 39\ sec$

Semi-log graph

$Slope\ = -0.0205$ sec
$\tau_S = -\frac{1}{Slope} = -\frac{1}{-0.0205} = 48.78\ sec \approx 49\ sec$

$\bar{\tau} = \frac{\tau_D + \tau_C + \tau_S}{3} = \frac{44 + 39 + 49}{3} = 44\ sec$ $C = \frac{\tau}{R} = \frac{44}{91 \times 10^4} = 48.35164835 \times 10^{-6}$ $C = 48.35164835\ \mu F$	$\Delta\bar{\tau} = \sigma m(\tau_D + \tau_C + \tau_S) = 2.886751346 \approx 3$ $\frac{\Delta C}{C} = \frac{\Delta\bar{\tau}}{\bar{\tau}} + \frac{\Delta R}{R} \rightarrow \frac{\Delta C}{48.35164835 \times 10^{-6}} = \frac{2.886751346}{\overline{48.78}} + \frac{45500}{91 \times 10^4}$ $\Delta C = 5.278984344\ \mu F \approx 5$

(4)Results:

- $\tau = 44 \pm 3\ sec$
- $C = (48 \pm 5)\mu F$

(5)Conclusions:

Discrepancy test→ | True value - Exp.value | ≤ 2ΔC
→ | 47-48 | ≤ 2×5→ 1 ≤ 10 → so, the result is accepted.

The result is accepted, the value I measured is very close to the true value. The actual value of C. manufacture=47μF, which is very close to the experimental result of 48μF, Its due to many possible reasons:

- **The way that the measurements was took is accurate**
- **I focused on taking measurements perfectly.**

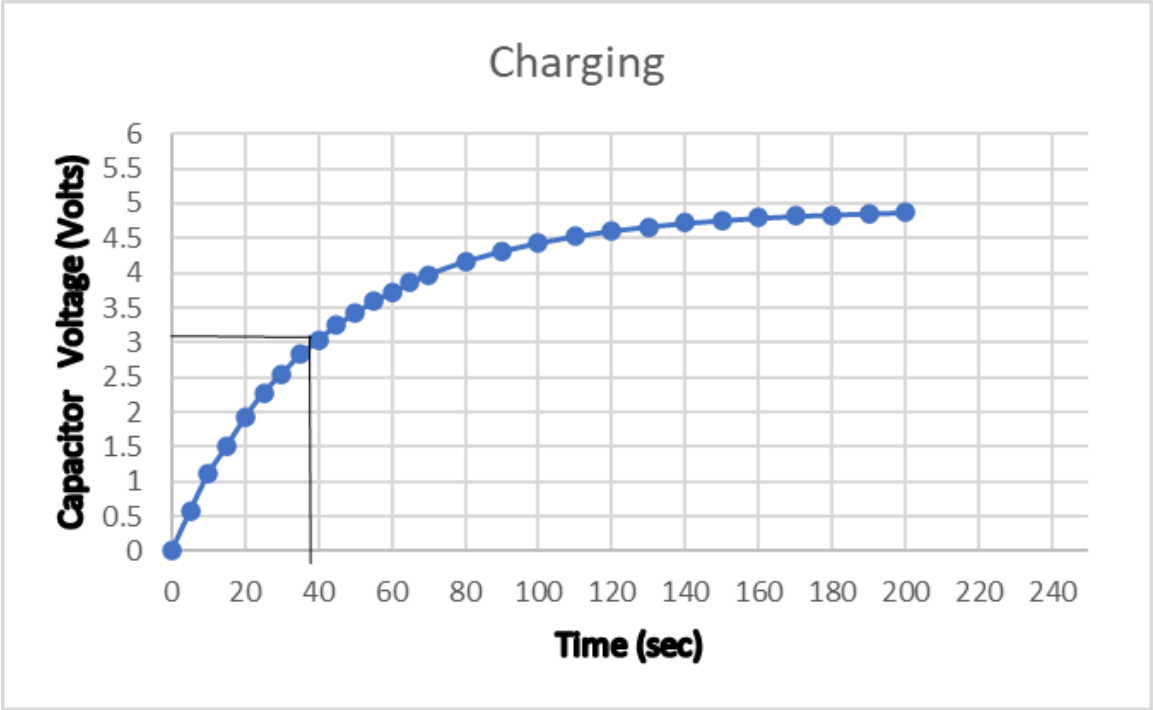
There are many mistakes that I could have made if I had not measured properly

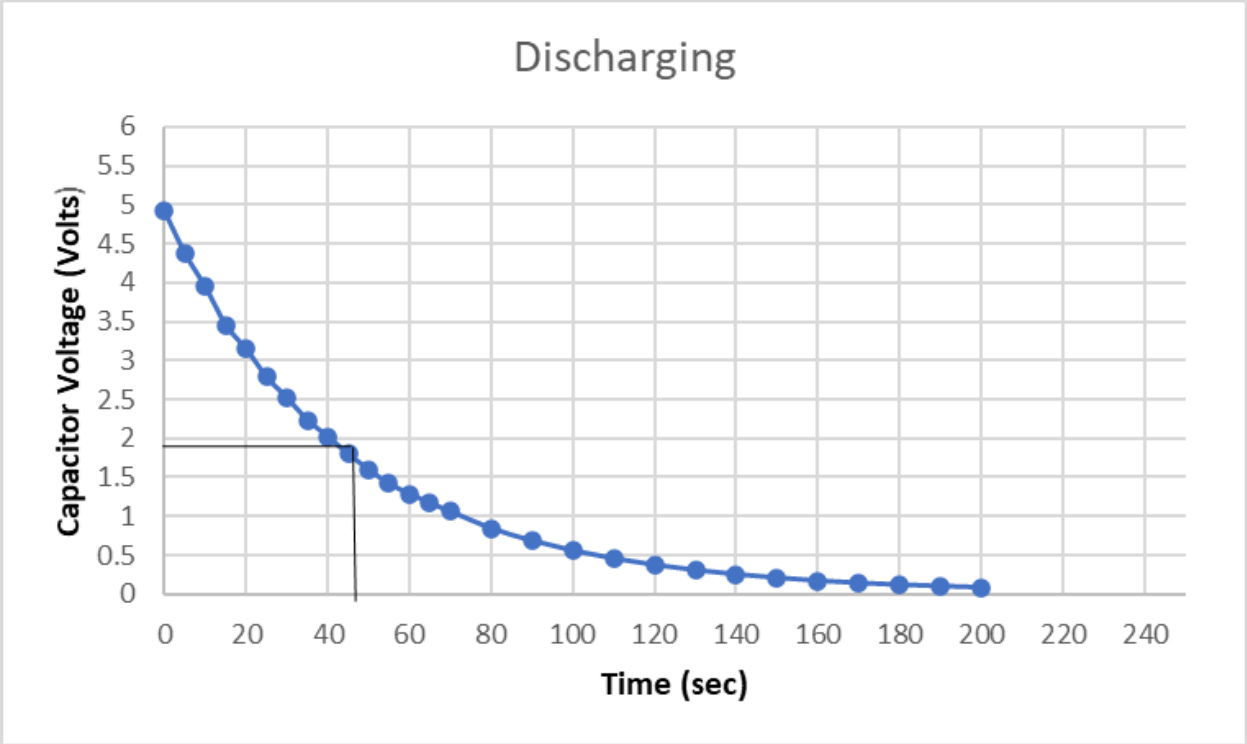
During the process of charging and discharging a capacitor and reading the value using a voltmeter, some possible errors may occur:

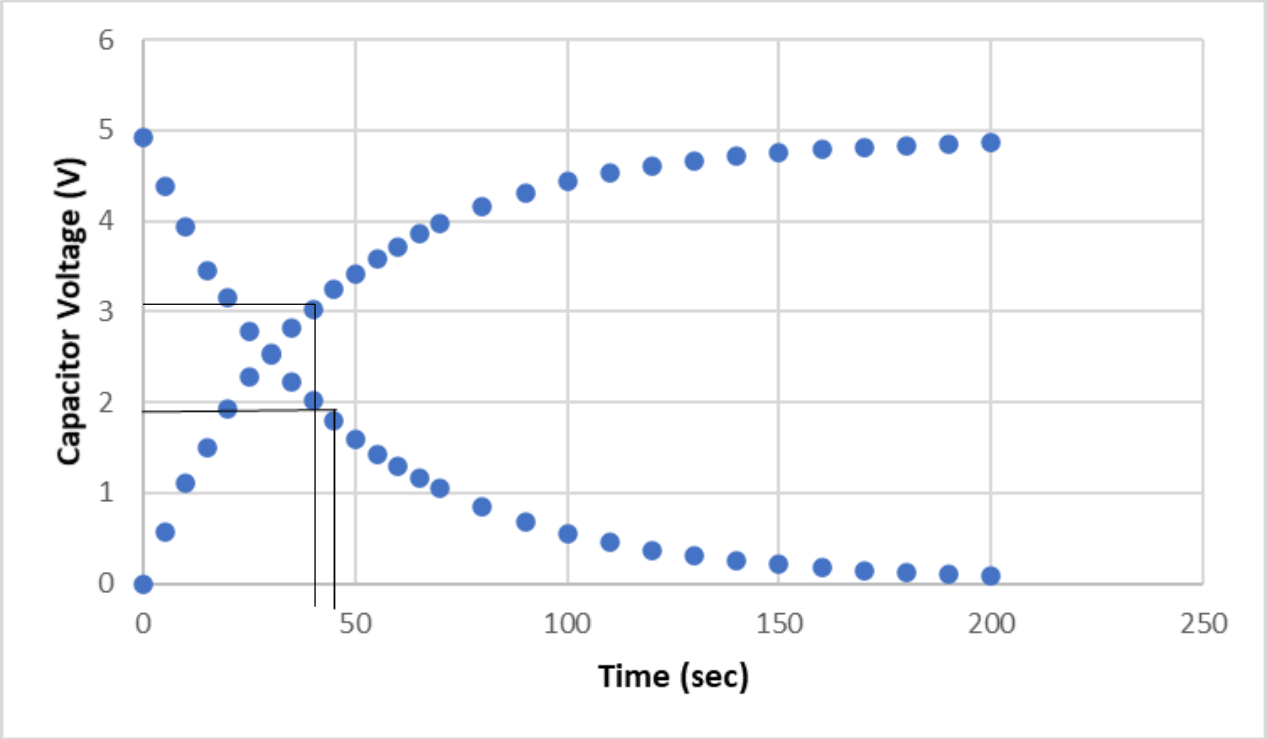
- **Charge leakage: If there is a leak in the capacitor, the charge may lose some of it unexpectedly.**
- **Loss of capacitance: Capacitors may lose their capacitance over time or as a result of repeated charging and discharging operations.**
- **Inaccurate reading: The reading on the voltmeter may be inaccurate due to external influences or a malfunction in the device.**
- **Resistance change: Thermal effects or electrical current may cause a change in the value of the resistance.**
- **Temperature effect: Temperature can affect the performance of the capacitor and its reading.**

There are some random errors, such as the error rate of the multimeter and the oscilloscope. There is also an error in the resistance and capacitor in the video. When I took the values, there was a slight difference in the time the video was recorded and the time the experiment was applied.

To ensure the accuracy of the measurements, it is preferable to follow the correct procedures and check the devices to make sure there are no technical problems.







Slope=-0.0205