Experimental General Physics for Engineers II

Laboratory Report PHYS 194 summer 2022

Section: L01_____

Experiment name: # RC dc circuit

Student Name:	Talha Abdullah Punjabi	Student ID	201903446

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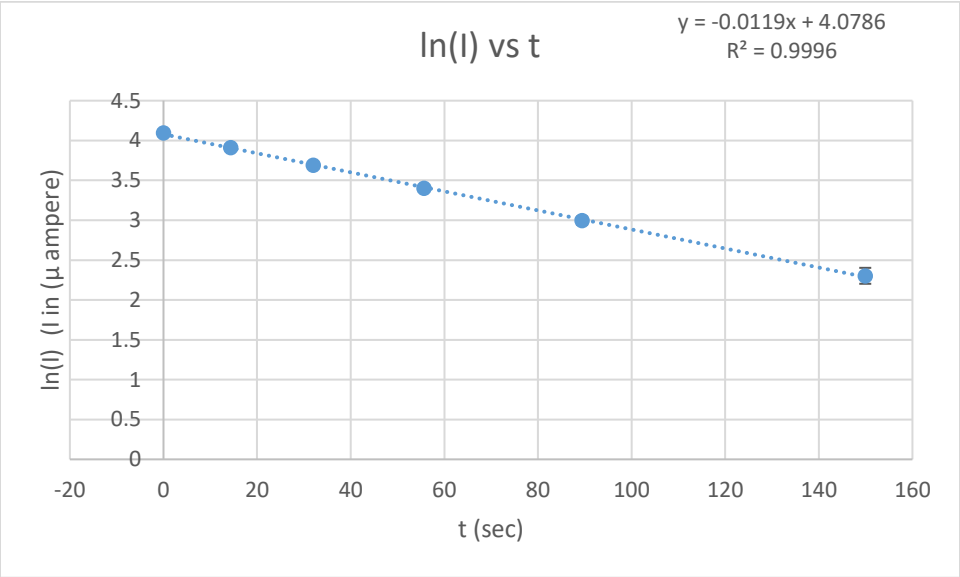
Table of results (1.25 pts)	
Graph (1.25 pts)	
Data analysis (2 pts)	
Discussion (0.5 pt)	
References	
Others	
Report Grade (5 pts)	

1. Table of results, charging the capacitor (Put correct units in the tables)

I (μ ampere)	$u(I)$ (μ ampere)	$ln(I)$ (I in μ ampere)	$u(\ln(I))$ (I in μ ampere)	t (sec)	$u(t)$ (sec)
60	±1	4.094	±0.02	0	±0.01
50	±1	3.912	±0.02	14.34	±0.01
40	±1	3.689	±0.03	31.98	±0.01
30	±1	3.401	±0.03	55.67	±0.01
20	±1	2.996	±0.05	89.42	±0.01
10	±1	2.303	±0.1	149.92	±0.01

2. Graph of $\ln(I)$ versus t

Insert the graph here (don't forget error bars)



3. Data analysis

3.1. Theoretical value of time constant τ and its propagated error

τ= RC

R= 30 KΩ ± 300 Ω

C= 2200 μF ± 100 μF

τ = (30x10^3) * (2200*10^{-6}) = **66 sec**

U(τ)= sqrt ((d(RC)/d(R) *U(R)) ^2 + (d(RC)/d(C) *U(C)) ^2)

= sqrt (((2200*10^{-6}) *300)^2 + (30x10^3 * 0.0001)^2) = **± 3 sec**

3.2. Calculation of the propagated error on $\ln(I)$

Show how you calculate $u(\ln(I))$

U(I) is directly measured which is ±1 μ ampere

First row,

U(ln(I)) = sqrt((d(ln(I)/d(I) * U(I))^2) = sqrt ((U(I)/I)^2) = sqrt ((1/60)^2) = **±0.02** (I in μ ampere)

3.3. Slope of the graph intercept and their uncertainties\

Slope = -0.01194 (sec^{-1})
U(Slope) = ±0.000122 (sec^{-1})
Intercept = 4.078634 (I in μ ampere)
U(Intercept) = ±0.009312 (I in μ ampere)

3.4. Intercept of the graph and I_0

Compare the value of the initial current I_0 you obtain from the graph intercept to the one you have used in the table.

Ln(I)= ln(I_0) – ($1/\tau$) *t, and $\text{Intercept} = \ln(I_0)$

$e^{Intercept}=I_0 = e^{4.079}$= 59.06 μ ampere

|Theoretical value-obtained value / Theoretical value | * 100 = | 60-59.06 / 60 | *100 = **1.56%**

3.5. The experimental value time constant τ and its propagated error

Ln(I)= ln(I_0) – ($1/\tau$) *t, and $\text{Slope} = -(1/\tau)$

$\tau = -(1/\text{Slope}) = -1/-0.01194 = 83.75$ sec

$U(\tau) = \text{sqrt}\left((d(-1/\text{slope}) * U(\text{slope}) / d(\text{slope}))^2\right)$

$= \text{sqrt}\left(((1/\text{slope}^2 * U(\text{slope}))^2\right) = \text{sqrt}\left((1/-0.01^2 * 0.0001)^2\right) =$ **±1 sec**

3.6. Compare between the experimental and theoretical values of τ

|theoretical value – obtained value / theoretical value | *100= |66-83.75/66|*100 = **29.5%**

4. Discussion

(Give a brief comment on whether your results are in agreement with what was expected or not and mention all the possible sources of error that you may have faced during the experiment).

Results are in agreement with what was expected. The final answer had an error of 29.5% due to some sources of error. These errors included are inaccuracy of human and reaction time while recording the time using the stopwatch. An error also would be on the value and the error of capacitance used. Overall, a successful experiment with an error of 29.5%

References