**PHYSICS 1E03 LAB 3 WRITE-UP**

**Name:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**  **Lab Section:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Student No:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** **Date:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Partner:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Lab Section:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Student No:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Station Number:\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**RESULTS**

**PART 1: Discharging the Capacitor**

**Finding the Time Constant** $τ\_{1/2}$

Table 1: Time required for $V\left(t\right)$ to fall to $\frac{1}{2}V(0)$

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| --- | --- |
| Resistance($kΩ$) | Time $τ\_{\frac{1}{2}}$ to reach $\frac{1}{2}V(0)$ $∀ τ\_{\frac{1}{2}}$ ( ) |
| $$V\left(0\right)=8V $$ | $$V\left(0\right)=6V $$ | $$V\left(0\right)=4V $$ |
| 1 |  |  |  |
| 5 |  |  |  |
| 10 |  |  |  |

Table 2: Calculating capacitance from average $τ\_{\frac{1}{2}}$ values

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| --- | --- | --- | --- |
| Resistance(k$Ω)$ | Average $τ\_{\frac{1}{2}}$ for each resistor ( ) | Standard deviation of $τ\_{\frac{1}{2}}$ for each resistor ( ) | Calculated C with average $τ\_{\frac{1}{2}}$$C=\frac{τ\_{\frac{1}{2}}}{Rln\left(2\right)}$ ( ) |
| 1 |  |  |  |
| 5 |  |  |  |
| 10 |  |  |  |

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| Average C (calculated) = |

C (manufacturer’s value) =

**Linear Regression with Voltage versus Time**

$t\_{o}=$**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

$t\_{o}+2τ\_{\frac{1}{2}}=$**\_\_\_\_\_\_\_\_\_\_\_\_ (use the average** $τ\_{\frac{1}{2}}$ **for R=**$1kΩ$**)**

**Circuit\_1 Graph**

Place your graph for Circuit\_1 from the procedure for the “Linear Regression with Voltage versus Time” here.

**RESULTS**

**PART 2: Charging through a Resistor**

$Q=$**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

$C=$**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (use the equation Q=CV for the voltage of the power supply)**

**Circuit\_2 Graphs**

Place your graphs for Circuit\_2 from the procedure in Part 2 here. Make sure your graphs are properly labeled and titled within Capstone before adding the snip to your report.

**DISCUSSION AND CONCLUSIONS**

Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

***Question*** 1. Does the $τ\_{\frac{1}{2}}$ value depend on the initial voltage? Justify your answer.

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***Question*** 2. Is the average of your calculated capacitance C within 20% of the nominal value, as the manufacturer claims? If the calculated capacitance is not within 20% of the nominal value, provide possible sources for the discrepancy.

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***Question*** 3. Is this graphically determined value of C consistent with your previous average C value? If not, give reasons why you think this discrepancy might have occurred.

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***Question*** 4. What is the significance of the y-intercept for your trendline? Recall: time needs to be written with respect to $t\_{o}$.

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***Question*** 5. What other types of systematic or random uncertainties may exist within this experiment for Circuit\_2?

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***Question*** 6. When calculating the capacitance from the total accumulated charge, does it match the manufacturer’s claim that the capacitance is within 20% of the nominal value? Explain. If the calculated capacitance is not within 20% of the nominal value, provide possible sources for the discrepancy.

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***Question*** 7. Using the manufacturer’s middle value of $C= 10000μF$, what is the value of the time constant ($τ=RC) $for Circuit\_2 in SI units? At time $τ=RC$ on your Voltage versus Time graph, is the value for voltage what you expect? Explain. **Note**: for voltage of the power supply, use the voltage that your voltage versus time graph asymptotes to.

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***Question*** 8. Repeat the calculation of the time constant (𝜏 = 𝑅𝐶) with your experimentally determined values of 𝐶 from Part 1 instead. Do they provide a more accurate result for 𝜏 as per the definition of the time constant? Explain.

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