**Report 2: RC Circuits**

|  |  |
| --- | --- |
| **Class (e.g. A21, C18, etc.)** | **Group Number (e.g. Group 1, 2, etc.)** |
| **Class** | **Group** |

### Please leave Report Feedback blank, your tutor will use this area to give you feedback.

|  |  |
| --- | --- |
| **Report Feedback** | |
| **Grade Awarded** |  |
| **Penalty (for late submission / plagiarism)** |  |
| **Final Grade** |  |
| **Marker’s Signature** |  |
| **Areas you did well:** | |
|  | |
| **Suggested areas for improvement:** | |
|  | |
| **Student action plan:** | |
|  | |



**COURSEWORK SUBMISSION FORM**

**TO THE STUDENT: Please complete the boxes, and submit the form together with two copies of your essay/coursework (one printed copy and one electronic copy).**

|  |  |  |
| --- | --- | --- |
| **Name (s)** | **ID Number (s)** | **Date of Experiment** |
| **Module Title:** Foundation Physics | | **Module Convenor:**  Stephen Ntiri Asomani |
| **Coursework Title:** RC Circuits | | **Module Code:** CELEN039 |

|  |
| --- |
| **Compulsory**  **I/We have read the section relating to plagiarism in the University’s Regulations and confirm that the attached submission is my/our own work. I/We understand that 5 marks per working day will be deducted from the final mark for lateness, unless an extension form has been authorised and is attached, e.g. a mark of 42 minus 5 marks changes to 37.**  **The deadline for handing in coursework is 3 pm.**  **Signature (s)**  **……………………………………………………………………………………..……………………**  **……………………………………………………………………………………………..……………** |

|  |
| --- |
| Optional  I/We give permission for the attached piece of work to be used for future research and training purposes.  Signature (s)  ……………………………………………………………………………………..……………………………………….………… |

**--------------------------------------------------------------------------------------**

**OFFICE USE ONLY**

**Copies received 1 or 2**

|  |  |  |  |
| --- | --- | --- | --- |
| **Date & Time**  **Received**  **Late: YES / NO** | **Penalty** | **Extenuating**  **Circumstances**  **YES / NO** | **Evidence**  **Attached**  **YES / NO** |

### 

### This template is designed to provide you with the general structure of a scientific report.

### Text in purple and blue are instructions/advice on what to do or where to find out additional information about writing a particular part of the report.

### You **MUST** **make sure you delete all of the purple and blue text** from the template before you submit your finished report.

When writing a lab report the whole document must be written in the past passive voice, for more information you can watch the video “Writing in the Past Passive voice” on Moodle.

Below you will find each section of the report alongside additional instructions on what to do to complete each section.

### **ABSTRACT:**

The abstract should be a single paragraph and summarise the overall report. The Abstract should include;

* A statement of the hypothesis being tested in this experiment.
* A brief explanation of how the hypothesis was tested.
* A summary of the conclusion of the report.

You should also refer to “Abstract – Video Guide” in the “Report Writing” section of Moodle for to help you complete this section.

### **OBJECTIVES:**

The objective of this experiment is to examine how the voltage across a capacitor changes with time, which states that:

=

Eqn.1

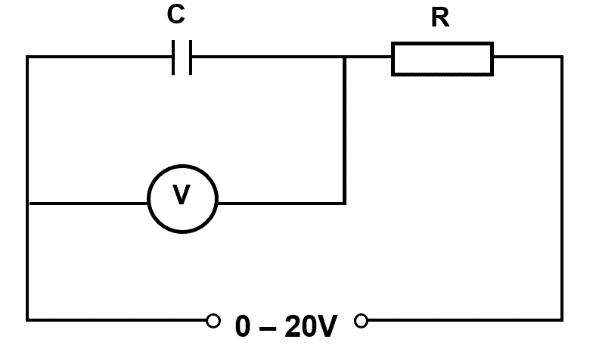
A capacitor with an initial voltage is discharged through a resistor starting at t=0,then its voltage decreases exponentially.

### **INTRODUCTION:**

The introduction section should include (in order);

* A brief introduction/history of the capacitor, this should be at most 2 short paragraphs.
* A statement of the hypothesis being tested in the experiment. This should come at the end of your introduction paragraph(s).
* Figure 1 (see below)
* **The mathematical derivation** oftheformulae for the voltage across a capacitor in an RC circuit as the capacitor is discharging, , this **MUST** include **reference to Figure 1.** You must show all the steps involved in deriving this equation. **Hint:** use your textbook to help you.

Figure 1 shows the RC circuit, you are not required to edit the diagram, but you should reference it when deriving your formula.



**Figure 1*.*** Circuit diagram of the RC circuit

You should also refer to “Objectives & Introduction – Video Guide” in the “Report Writing” section of Moodle for to help you complete this section.

### **ASSUMPTIONS:**

The assumptions section should take the form of a bullet point list of the major assumptions of this experiment, do not forget the key assumption that shows that a pendulum bob can undergo simple harmonic motion.

You should also refer to “Objectives & Introduction – Video Guide” in the “Report Writing” section of Moodle for to help you complete this section.

### **APPARATUS**

The apparatus section should take the form of a bullet point list, stating all of the equipment/resources that were used to perform the experiment.

You should also refer to “Apparatus & Procedure – Video Guide” in the “Report Writing” section of Moodle for to help you complete this section.

### **PROCEDURE**

The procedure should state what was done during the experiment in sufficient detail that another scientist who has not seen the experiment could understand what you have done and could repeat the experiment themselves. The procedure should be written in paragraphs, **NOT** as a list or bullet points.

A good tip for writing the procedure is to paraphrase the key pointsof the instruction from the lab worksheet in the past passive voice.

You should also refer to “Apparatus & Procedure – Video Guide” in the “Report Writing” section of Moodle for to help you complete this section.

**RESULTS:**

1)A sample calculation for the value of the natural log of the voltage ratio, ,They are recorded in Table1.As an example, when , ,theis calculated to be:

==-0.0870

2)A sample calculation for the value of the predicted time, , for measurement 2 in Table 1. As an example, when R=14.9kΩ,C=2200μF, =5.5V, the  is calculated to be:

=-RC-(1.49××2.2×)×=2.85s

3)A sample calculation for the value of the measured time ,for measurement 2 in Table 1. As an example, when =2.62,, , the is calculated to be:

===2.67s

**Table 1.** Time taken for the capacitor to discharge.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| *Measurement no* | Voltage |  | Time | | | | |
|  |  |  |  |  |
| 1 | 6.0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 2 | 5.5 | -0.0870 | 2.62 | 2.68 | 2.71 | 2.67 | 2.85 |
| 3 | 5.0 | -0.1823 | 5.79 | 6.09 | 5.98 | 5.95 | 5.98 |
| 4 | 4.5 | -0.2878 | 9.70 | 9.82 | 9.63 | 9.72 | 9.43 |
| 5 | 4.0 | -0.4055 | 13.70 | 13.70 | 13.70 | 13.70 | 13.29 |
| 6 | 3.5 | -0.5390 | 17.91 | 18.41 | 18.54 | 18.29 | 17.67 |
| 7 | 3.0 | -0.6932 | 23.46 | 23.91 | 23.90 | 23.76 | 22.72 |
| 8 | 2.5 | -0.8755 | 29.55 | 30.00 | 29.73 | 29.76 | 28.70 |
| 9 | 2.0 | -1.0986 | 37.00 | 37.66 | 37.60 | 37.42 | 36.01 |
| 10 | 1.5 | -1.3863 | 47.17 | 47.68 | 47.48 | 47.44 | 45.44 |
| 11 | 1.0 | -1.7918 | 61.64 | 62.50 | 62.04 | 62.06 | 58.73 |

**Table 2.** Measured and predicted values for the trendline coefficients.

|  |  |  |
| --- | --- | --- |
|  | **Predicted Value** | **Measured Value** |
| **Gradient** | -32.78 | -34.576 |
| **Intercept** | -6× | -0.2956 |

**UNCERTAINTY ANALYSIS:**

1)The sample calculation for the uncertainty for the measured voltage,.These are recorded in Table 3. As an example, we use V=5.5V

===0.116V

2) The sample calculation for the uncertainty for the initial voltage,.These are recorded in Table 3. As an example, we use =6.0V

===0.118V

3)The sample calculation for the standard uncertainty for the predicted time, , for measurement 2 in Table 3. As an example, We use R=14.9kΩ,C=2200μF, =5.5V, and the following formula to calculate it.

The uncertainty of R can be calculated to be:

𝛿𝑅=0.01𝑅=0.01×14.9×=149Ω

The uncertainty of C can be calculated to be:

𝛿𝐶=0.01𝐶=0.01×2.2×=2.2× F

So the standard uncertainty for the predicted time, ,can calculate to be：

=0.9360s

**Table 3.** Uncertainty associated with measured and predicted period.

|  |  |  |  |
| --- | --- | --- | --- |
| *Measurement no* |  | Time | |
|  |  | |
| 1 | 0.118 | 0.8340 | 0.9132 | |
| 2 | 0.116 | 0.8945 | 0.9360 | |
| 3 | 0.114 | 0.9779 | 0.9785 | |
| 4 | 0.112 | 1.0947 | 1.0349 | |
| 5 | 0.110 | 1.2601 | 1.1103 | |
| 6 | 0.108 | 1.5037 | 1.2127 | |
| 7 | 0.106 | 1.8796 | 1.3554 | |
| 8 | 0.105 | 2.4911 | 1.5620 | |
| 9 | 0.104 | 3.6014 | 1.8798 | |
| 10 | 0.103 | 5.9479 | 2.4189 | |
| 11 | 0.103 | 12.4863 | 3.5069 | |

**DISCUSSION:**

The discussion section of the report is where you discuss the results of the experiment. It is here you can demonstrate that you understand what the data is telling you by comparing your measured (actual) results with the predicted results.

The discussion is generally split into 3 paragraphs;

* In the first we compare the measured and predicted results (both the table values and the trendline values),
* In the second we consider the correlation coefficients (and what they tell us about the relationship between x and y),
* In the third we look for any patterns in the data and discuss possible reasons why the measured values may differ from the predicted values.

Use the following questions to help you write your 3 discussion (do not just answer the questions: form your responses into coherent sentences & paragraphs):

Paragraph 1:

* How many of measured results agreed with the predicted results?
* Do the trendline values for the measured data agree with the trendline values from the predicted data (use the values from Table 2, do these values agree within uncertainty or not)?
* Do the trendline values support your hypothesis or not?
* Overall, do the results support your hypothesis or not?

Paragraph 2:

* What does the coefficient of determination, tell you about the how the variables you have plotted on your graph are related?
* What does the product moment correlation coefficient, , tell you?
* Do the coefficient of determination and product moment correlation coefficient support a straight-line relationship between x and y or not?

Paragraph 3:

* Is there an observable pattern to how the measured and predicted results differ?
* For measured results that differed from your predicted results (outside of the uncertainty range), what are the possible sources of these discrepancies? Hint: consider your assumptions

**N.B.** It is not enough to say yes or no; your answer must be backed up by referencing data from the results section.

You should also refer to “Discussion – Video Guide” in the “Report Writing” section of Moodle for to help you complete this section.

**CONCLUSION:**

The conclusion section is where you come to a final decision regarding whether or not the experiment supports the hypothesis or not. It should be split into two paragraphs as shown below.

Use the following questions to help you write your conclusion (do not just answer the questions: form your responses into coherent sentences & paragraphs):

Paragraph 1

* What was the initial hypothesis for the experiment?
* Based on what you have said in the discussion section, does your experiment demonstrate the validity of your hypothesis or not?

Paragraph 2

* Which of the factors from the discussion section is the main source of any measured results differing from predicted results?
* What improved experimental techniques or mathematical models could account for these discrepancies in future investigations?

(**N.B.** It is not enough to say yes or no; your answer must have been justified in the discussion section and you should refer to what you have said in the discussion section).

You should also refer to “Conclusion – Video Guide” in the “Report Writing” section of Moodle for to help you complete this section.