

RC Circuits Lab

Name:

Partner:

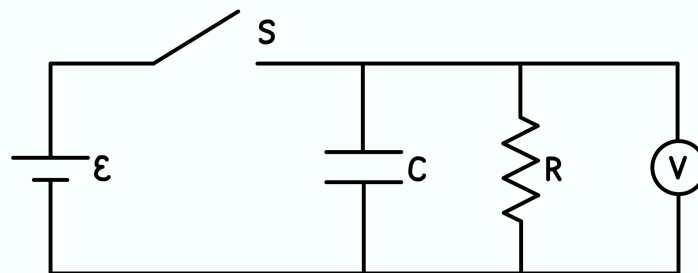
Block:

**Objective**

Determine the time constant of an RC circuit

**Introduction**

In this experiment you will study a simple circuit containing a resistor and a capacitor. Answer the following in terms of the emf  $\mathcal{E}$ , resistance  $R$  and capacitance  $C$ .



1. Assume the capacitor is initially uncharged. What is the voltage across the capacitor when the switch  $S$  is closed?
2. Describe the voltage across the capacitor after the switch is opened again. Express the voltage as a function time.
3. What is the time constant of the RC circuit when discharging? What does the time constant represent?

### Experimental Method

To perform the experiment, assemble the circuit as indicated. Try to arrange the wiring so that it is easy to connect and disconnect the wire leading to the 'top' of the capacitor as indicated by the switch in the diagram. Once the switch is opened, collect instantaneous voltage data across the capacitor.

Use a multimeter to directly determine the actual resistance of the resistor and the actual capacitance of the capacitor.

### Data

Include a table of the raw data. Include all calculated data for the linearized plot.

### Analysis and Discussion

Determine the voltage as a function of time and the time constant of your RC circuit. Your report should include the following:

- A plot of the original data
- A linearized plot
- The equation of your best fit line
- The slope and  $y$ -intercept of your best fit line (include units)
- The experimentally-determined expression for voltage as a function of time
- The experimentally-determined time constant  $\tau_{\text{experimental}}$
- The theoretical time constant  $\tau_{\text{theoretical}}$
- Percent error

Component	Criterion	Weight	Mark
General	<i>Complete word-processed lab report with proper structure and formatting</i>	1	
Data	<i>Data quality and presentation</i>	2	
Analysis and Discussion	<i>Plot of the original data</i>	1	
	<i>Linearized plot</i>	1	
	<i>Slope and y-intercept of linearized plot</i>	1	
	<i>Expression for voltage as a function of time</i>	1	
	<i>Experimental time constant</i>	1	
	<i>Theoretical time constant with percent error</i>	1	
	<i>At least two <u>significant</u> sources of error</i>	1	
TOTAL		10	