Charging and Discharging Capacitors

Charging capacitors:

When a capacitor is charged through a resistor from a DC power supply, the charge on the capacitor and the voltage across the capacitor will increase with time. The voltage V, as a function of time is given by:

$$V = V_0\left(1 - e^{-t/RC}\right)$$

Where: $\mathbf{V_0}$ is the charging voltage.

After a time **t = RC (one time constant)**, the voltage across the capacitor has increased to **63%** its maximum value (**V = 0.63 $\mathbf{V_0}$** at **t=RC**).

Take the reading of the electrometer (voltage across the capacitor) at each second and tabulate your results as follows:

Time (s)	*Voltage (V)*
0	
10	
20	
30	
40	
50	
60	
70	
80	
90	
100	
110	
120	

Time (s)	*Voltage (V)*
130	
140	
150	
160	
170	
180	
190	
200	
210	
220	
230	
240	
250	

V_0 =

0.63 V_0 =

$$\tau_{theoretical} = RC =$$

Plot a graph of the voltage **V (y axis) vs. Time t (x axis)** and from the graph find the value of the time constant corresponding to 0.63 V_0

$$\tau_{experimental} =$$

Discharging capacitors:

When a capacitor is discharged through a resistor, the charge on the capacitor and the voltage across the capacitor will decrease with time. The voltage V, as a function of time is given by:

$$V = V_0 e^{-t/RC}$$

Where: V_0 is the charging voltage.

After a time **t = RC (one time constant),** the voltage across the capacitor has decreased to **37%** its maximum value (**$V = 0.37\ V_0$** at **t=RC**).

Take the reading of the electrometer (voltage across the capacitor) at each second and tabulate your results as follows:

Time (s)	*Voltage (V)*
0	
10	
20	
30	
40	
50	
60	
70	
80	
90	
100	
110	
120	

Time (s)	*Voltage (V)*
130	
140	
150	
160	
1701	
180	
190	
200	
210	
220	
230	
240	
250	

V_0 =

$0.37\ V_0$ =

$$\tau_{theoretical} = RC =$$

Plot a graph of the voltage **V (y axis) vs. Time t (x axis)** and from the graph find the value of the time constant corresponding to $0.63\ V_0$

$$\tau_{experimental} =$$