Experiment 4: To determine the capacitance of a capacitor using the time constant.

In this experiment you are to determine a capacitance by measuring the time constant of RC circuits. Record all observations and deductions in the spaces provided on page 8.

(a) Connect the circuit shown in Fig. 2.1 using a 10 kΩ resistor for R. Make sure that both switches are open.

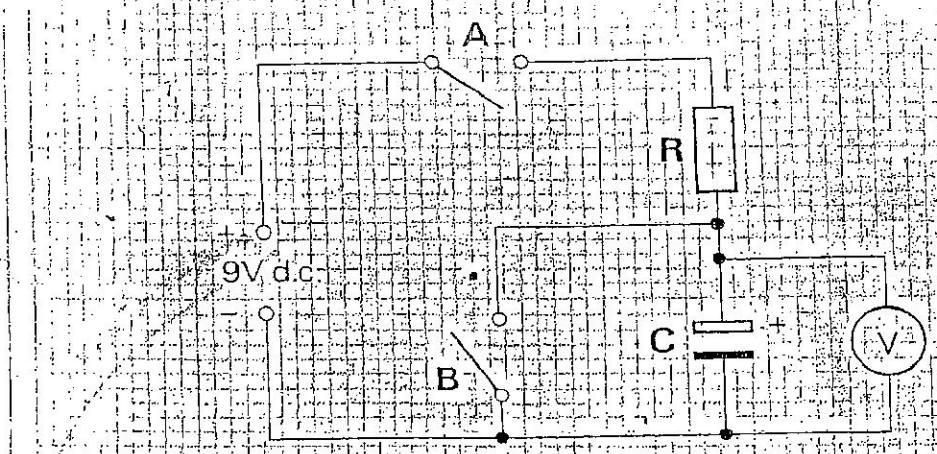

Fig. 2.1

Close switch A and wait for the voltmeter reading to reach V_0, its maximum value. Record V_0 and the value of S, where $S = 0.632\ V_0$.

Open A and close B to discharge the capacitor.

(b) The time constant τ of the circuit is equal to the time taken for the voltage to reach S after switch A is closed with the capacitor initially discharged and switch B open. Measure the time constant of the circuit as accurately as you can.

(c) Replace the 10 kΩ resistor with one of the other resistors and determine the new value for τ. Repeat the procedure until you have values of the time constant for circuits containing each of the resistors provided.

Tabulate all your values of τ and R, the value of the resistance used.

(d) Use the grid on page 9 to plot a graph of τ/s (y-axis) against R/kΩ (x-axis).

Given that $\tau = RC$, use the graph to obtain a value for C, the capacitance of C.

(e) The resistance values are quoted to a tolerance of 1%. State a range of values in which the true value of capacitance might lie. Show how you arrived at your answer.