CAPACITOR DISCHARGE

Hand in a copy of the resulting spreadsheet. The entire write-up should be contained within it.

NAME: .... HOUSE: .....

CLASS: .... DATE: ..... TEACHER: .....

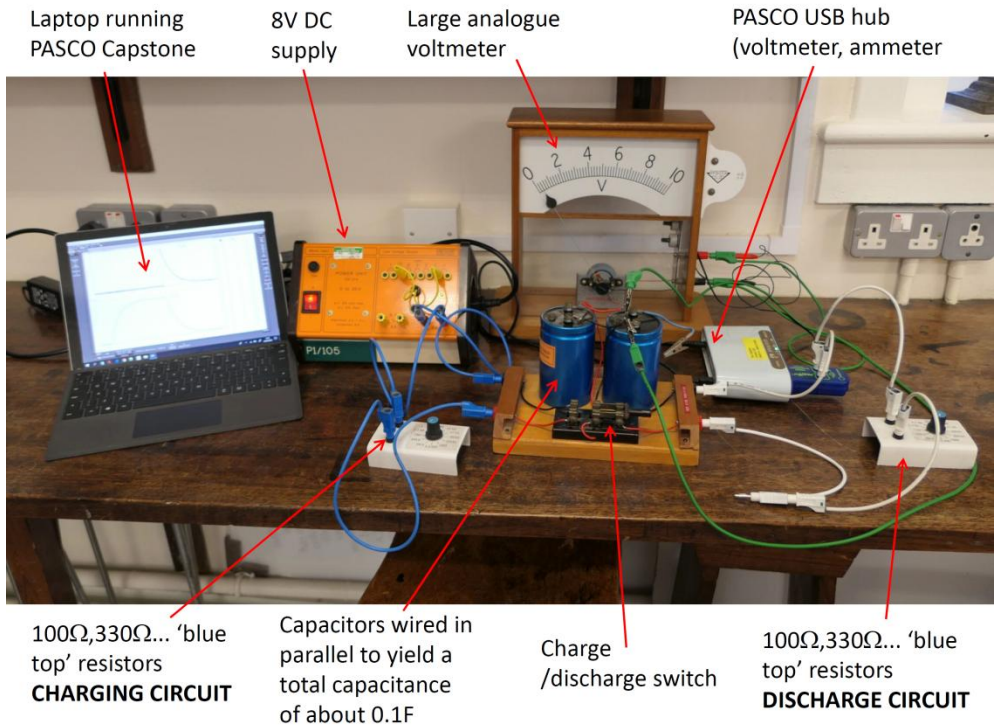
Aims of this experiment:

1. Take datalogger (and observe analogue voltmeter) current, time and voltage measurements for a charging and then discharging capacitor circuit. A fixed DC voltage source is used for charging, and fixed resistors are used in both charging and discharging circuits. Start with the smallest resistance (about 100Ω).
2. Copy the datalog measurements into Excel and plot the charging and discharging capacitor voltages vs time. Also plot discharge current vs time.
3. Plot the discharge (only) voltage vs time, and from a graph of lnV vs t, determine the RC time constant for the circuit.
4. Measure the resistance of the discharging resistor precisely with a multimeter, and hence determine the capacitance.
5. If time allows, repeat the experiment with a larger resistance.

TASK 1: Use the multi-meter (in resistance mode) to work out the actual resistance of the 100Ω rated resistor in the **DISCHARGE** circuit.

R = ... Ω

TASK 2: Set up the circuit using the diagram on the right. **Check with your teacher before proceeding.** **Note this might be set up as a demo, so in this case all students should take turns in using the equipment individually to collect data.**



TASK 3: Use **Capstone** to record a full charge, then discharge. Perform two cycles of charge, discharge using 100Ω for charge and discharge, then 330Ω for both charge and discharge. Use 10Hz data rates for *both* voltmeter and ammeter.

Copy the data to **Excel** and plot capacitor voltage vs time. Also plot the discharge current vs time. Note meaningful current measurements will only be made during discharge, as the ammeter is connected in series to the discharge circuit.

Make sure all axes are properly labelled, and also annotate the V vs t curves with information such as resistance etc. **Also make a sketch of the charge and discharge circuits (with all components clearly defined) on your spreadsheet.**

TASK4: Record discharge data using the 100Ω resistor. Plot the discharge (only) voltage vs time, and from a graph of $\ln V$ vs t, determine the RC time constant for the circuit.

Use the measured value of the resistance (**TASK1**) to calculate the **capacitance** C (in F).

TASK5: Comment on the *correlation* of an *exponential decay* model of capacitor voltage with your measurements.

$$V = V_0 e^{-\frac{t}{RC}}$$

EXTENSION: Repeat TASKS 1,4,5 using a 330Ω discharge resistor. (Use a separate spreadsheet).