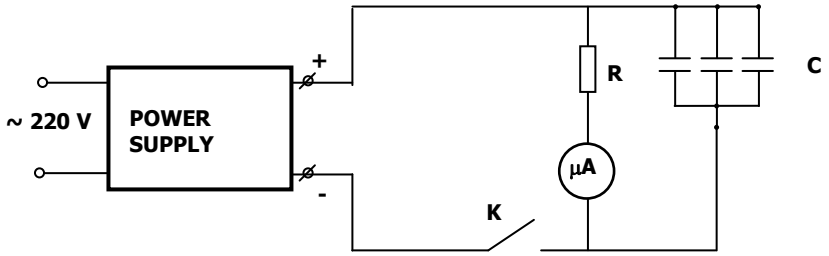
12 - RELAXATION PROCESSES IN ELECTRICAL CIRCUITS

I. Capacitor charging (discharging) process analysis

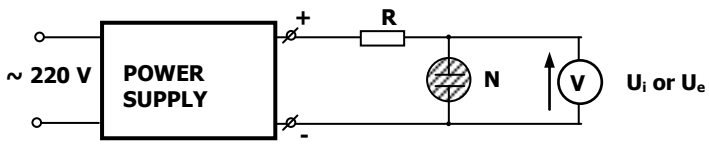


1. Build the circuit shown in the figure alongside. Close the switch K for a brief moment to charge the capacitor and open the switch starting the process of the capacitor discharging (C – electrolytic capacitor 100 μF, R – resistor 100 kΩ).
2. Measurements of the charging current (or discharging) read every 5 seconds should be written in the table. R and C accuracy is 1%.

C[μF]	R[kΩ]	I_0 [μA]	T [s]					
			0	5	10	15	20	25...
C_1=	R_1 =							
	R_2 =							
C_2 =	R_1 =							
	R_2 =							

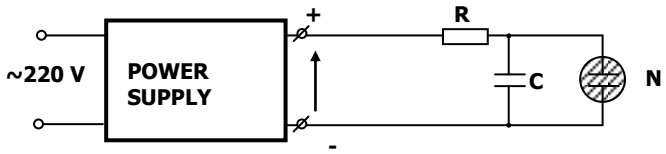
3. Stop the measurements after the time t=3τ when the current value falls to about 5% of the initial value.

II. Measurement of ignition Ui and extinction Ue voltages of neon lamp



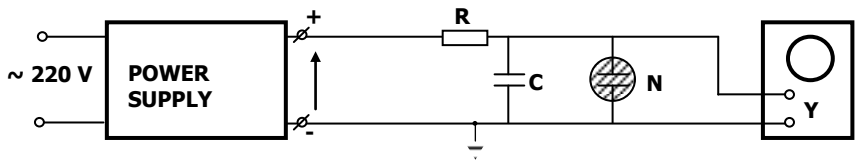
1. Build the circuit shown in the figure alongside (R=50 kΩ). Use the **digital voltmeter (range 100 V, DC**) to measure voltage.
2. Turn the voltage knob on the power supply very slowly to increase the voltage till the moment the lamp ignites.
3. Write down the highest voltage read **BEFORE** the ignition, Ui (when the lamp ignites, the voltage falls by a dozen or so volts to the so-called maintaining voltage).
4. Reduce the voltage and write down Ue voltage at each the gas stops glowing. Repeat the measurement several times, and write down the results in table. Calculate their average values. Consider the uncertainties type A and B.

III. Analysis of oscillation period dependence with respect to resistance R and capacitance C



1. Build the circuit shown in the figure alongside (C – capacitors 2 μF, 1 μF i 0.47 μF, R – resistors from 300 to 850 kΩ).
2. Set such a voltage U, to see neon lamp flashing for each measured resistance R (the power supply voltage has to remain constant during the measurement).
3. Measure at least twice time of n=20 flashes of neon lamp for various subsequent R values. The measurement result and the calculated oscillation period have to be written in table.
R and C accuracy is 5%.

IV. Observation of relaxation oscillation on the oscilloscope screen



1. Build a circuit shown above. Make sure to connect correctly the GND terminal of the power supply and the oscilloscope, and to use in the circuit a resistor R of a lower resistance.
2. Basing on observations of the waveform in the screen, estimate the capacitor's charging and discharging times.

NOTICE: DIGITAL VOLTMETERS ACCURACY:

V530, V531, V541, V543, V544: c_1 = 0,05%; c_2 = 0,01% (for all DC voltage ranges)