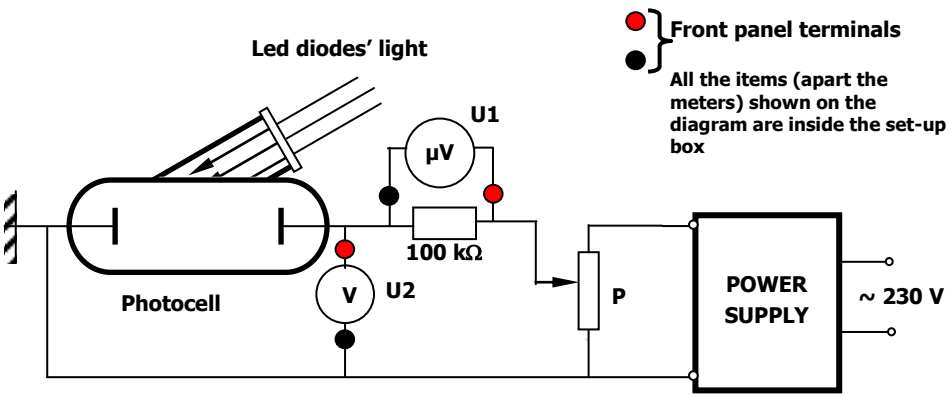
36 - PHOTOELECTRIC EFFECT
SETUP B

I. DETERMINATION OF PLANCK'S CONSTANT AND THE WORK FUNCTION



U1 Photocell current is measured indirectly through the measurement of the voltage on the 100 kΩ resistor. Meter: **PC5000A**, range mV.
Multimeter accuracy:
c_1=0.03%, c_2=0.02% (mV)
Resistor's accuracy: 0.1%

U2 Voltage between the anode and cathode, digital multimeter **(M890)**, Measurement range: 2, 20 Vdc.
Multimeter accuracy:
c_1=0.5%, c_2=0.1%

Use the supplied light sources. Each light source features a different light wavelength which is given on the separate plate.

1. Connect both multimeters to the measurement setup (please make sure you use the appropriate model for each circuit).
2. Turn the measurement setup on. (The blue LED on the front panel will light up.)
3. Set the 0 Voltage between anode and cathode by turning the **P** knob.
4. Insert the LED light source into the hole on the right panel of the main setup box. Please make sure the LED light is on.
5. Increase gradually the negative voltage between the anode and photocathode, until the U1 voltmeter shows **0 V**. Write down the stopping potential. Repeat this procedure three times, writing down the result (**V_h**).
   Please note that the voltages below the stopping potential a negative current (voltage) is observed. This is mainly caused by the photoelectric effect on the anode. The occurrence of this effect is one of the errors taking place in the determination of the stopping potential. The effect is negligible in this experiment, as the anode's photocurrent is very low.
6. Repeat the measurements for all the diodes.

λ [nm]	ν [Hz]	U_h[V]		
		1	2	3

7. Based on the least squares method (in Origin software) calculate the slope of the line representing the $V_h(\nu)$ relation. ($V_h e=h\nu-W$). Please calculate V_h as a mean value of three measurements. Calculate the Planck's constant and its uncertainty based on the slope value. Based on the intercept value, find the work function and its uncertainty.
8. Compare your result with the official table of physical constants. Comment on this. Please analyze χ^2 test results.

Useful physical constants

c=299792458 [m/s] e=1.60217733 x 10^{-19} [C] h=6.6260755 x 10^{-34} [Js]

II. MEASUREMENT OF CURRENT-VOLTAGE CHARACTERISTICS FOR THE ILLUMINATED PHOTOCELL

1. For two arbitrary chosen wavelengths (different LED sources), measure an entire current-voltage characteristics of the photocell: starting from the stopping potential (negative value!) till to the maximum positive voltage defined by the tutor. In the negative voltage range, the voltage has to be changed with 0.1 V increment. In the positive range (up to +1 V) use the 0.2 V increment. Above 1.0 V use the 0.5 V increment (if not told in the other way). Like in the first part of the experiment, the current is measured through the measurement of the voltage on the resistor. Recalculate the voltage to the current.

U_2 [V]	U_1 [V]

2. Draw the obtained results on a **COMMON** chart, marking the uncertainty bars.
   In your report, comment on the obtained charts and compare them with the theory.