E X P E R I M E N T A L P R O B L E M

Problem

Inside a black box provided with three terminals labeled A, B and C, there are three electric components of different nature. The components could be any of the following types: batteries, resistors larger then 100 ohm, capacitors larger than 1 microfarad and semiconductor diodes.

a)Determine what types of components are inside the black box and its relative position to terminal A, B and C. Draw the exploring circuits used in the determination, including those used to discard circuits with similar behaviour

b)If a battery was present, determine its electromotive force. Draw the experimental circuit used.

c)If a resistor was present, determine its value. Draw the experimental circuit used.

d)If a capacitor was present, determine its value. Draw the experimental circuit used.

e)If a diode was present, determine V_o and V_r, where V_o the forward bias threshold voltage and V_r is the reverse bias breakdown voltage.

f)Estimate, for each measured value, the error limits.

The following equipments and devices are available for your use:

1 back box with three terminals labeled A, B and C;
1 variable DC power supply;
2 Polytest 1 W multimeters;
10 connection cables;
2 patching boards;
1 100 kΩ, 5 % value resistor;
1 10 kΩ, 5 % value resistor;
1 1 kΩ, 5 % value resistor;
1 100 μF, 20 % value capacitor;
1 chronometer;
2 paper sheets;
1 square ruler;
1 interruptor.

Voltmeter internal resistance.

Scale	Value in kΩ	
0-1 V	3,2	1 %
0-3 V	10	1 %
0-10 V	32	1 %
0-20 V	64	1 %
0-60 V	200	1 %

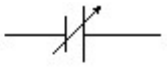
Ammeter internal resistance.

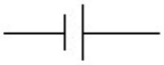
Scale	Value in Ω	
0-0,3 mA	1 000	1 %
0-1 mA	263	1 %
0-3 mA	94	1 %
0-20 mA	30,4	1 %
0-30 mA	9,84	1 %
0-100 mA	3,09	1 %
0-300 mA	0,99	1 %
0-1 mA	0,31	1 %

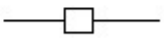
Notice: Do not use the Polystes 1 W as an ohmmeter. Protect your circuit against large currents, and do not use currents larger than 20 mA.

Give your results by means of tables or plots.

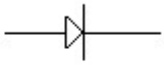
When drawing the circuits, use the following symbols:

Variable power supply 

Battery 

Resistor 

Capacitor 

Semiconductor diode 

Ammeter 

Voltmeter 