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Physics NYB

INTRODUCTION TO D.C. CIRCUITS AND CIRCUIT DIAGRAMS

During this lab, you will learn about the main elements of an electric circuit, how to draw an electric circuit scheme, how to measure the current, the voltage (potential difference) between two points, how to connect two light bulbs in series and in parallel and how to correlate the effect of released power on brightness and resistance of the bulbs. Note that the brightness of a bulb informs about the power provided through its terminals.

You will use three bulbs 15W- 12V, a DC source, a voltmeter, an ammeter, electric switches, wires and will rank the brightness of bulbs connected in circuit qualitatively according the following scheme:
0 - not glowing at all; 1- barely visible; 2- dim; 3-average; 4- more than average; 5- maximum brightness.

Calculate the bulb resistance as $R_{bulb} = V_{bulb}/I_{bulb}$ (1) and the power by formula $P = I * V$ (2)
Compare the resistance value from (1) to $R_{bulb} = P_{bulb} / I^2_{bulb}$ (3) ; check and explain the possible differences.

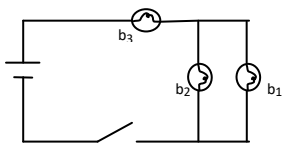
Start all experiments by drawing the electric scheme. Next, place the scheme elements on the desk in the same order as in the drawing. Then, connect them by wires, build the circuit and record the information. Don't forget to include a switch and apply the *same source voltage* V_{source} (6 to 12V) at all experiments.
Important Note: Make sure that the source voltage V_{source} ***is lower than 15V <u>when the switch is open</u>.***

1) Draw a circuit that contains a bulb(b_1), a switch, an ammeter and a voltmeter. Build the circuit on the desk, connect it to the DC source, turn the switch on and record: source voltage, bulb voltage, current provided by source, current through bulb and bulb brightness. Introduce these data in table #1. Disconnect one of the terminals of the source...record another time the information about voltage, current, brightness. Place the switch at another location in circuit ...do you see changes of recorded parameters? Calculate P_{bulb} and R_{bulb} .

2) Add another similar light bulb to get two bulbs in series (*label them* b_1 , b_2) in the drawn circuit. Try to predict whether the bulbs will be brighter or dimmer and if they will have equal or different brightness.
Next, build the circuit on desk and record: source voltage, current provided by source and for each bulb (voltage, current, brightness) . Introduce these data in table #2. Calculate P_{bulb} and R_{bulb} . What can you say about the resistance of the two bulbs in series.....is it equal, more or less than a single bulb? Does R_{bulb} of a single bulb change (say b_1) ..if yes why?

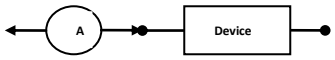
3) Replace the two bulbs in series with two bulbs in parallel in the circuit diagram. Try to predict whether the bulbs will be brighter or dimmer and if they will have equal or different brightness. Next, build the circuit on desk and record: source voltage, current provided by source and for each bulb(voltage, current , brightness). Introduce these data in table #3. Calculate P_{bulb} and R_{bulb} .What can you say about the resistance of the two bulbs in parallel..is it more or less than a single bulb? Does R_{bulb} of a single bulb(say b_1) change ..if yes why?

4) Draw and connect another bulb(*b3*) as shown in series with the two other bulbs in parallel. Before closing the switch, predict which bulb(s) will be brighter, dimmer and if any bulbs will have the same brightness. Next, record: source voltage, current provided by source and for each bulb(voltage, current , brightness). Introduce these data in table #4. Calculate P_{bulb} and R_{bulb} . Does the observed brightness of bulbs fits to your predictions? Does R_{bulb} of a single bulb(say b_1) change ..if yes why?

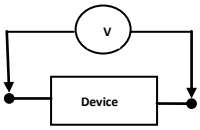


5) Return to the scheme with two bulbs in series. Draw the place in circuit where you would add a second equal D.C. source so as to restore the same brightness as the single bulb in experiment 1. Justify your choice. Show clearly the polarity of the terminals for each DC source.

Notes: 1. Two devices are connected in series if same current passes through each of them.
To measure the current passing through a device, one must connect an **ammeter** *in series* with this device.



2. Two devices are connected in parallel if same voltage applies on each of them.
To measure the voltage applied on a device, one must connect a **voltmeter** *in parallel* with this device.



DC Voltmeter

DC Ammeter

Multimeter

Table#1

	Voltage	Current	Power	Brightness	$R_{bulb} = V_{bulb} / I_{bulb}$	$R_{bulb} = P / I^2$
DC Source				----------		
Bulb Predictions						
Bulb measurements						

Table#2

	Voltage	Current	Power	Brightness	$R_{bulb} = V_{bulb} / I_{bulb}$	$R_{bulb} = P / I^2$
DC Source				----------		
b1 Bulb Predictions						
b1 Bulb measurements						
b2 Bulb Predictions						
b2 Bulb measurements						

Table#3

	Voltage	Current	Power	Brightness	$R_{bulb} = V_{bulb} / I_{bulb}$	$R_{bulb} = P / I^2$
DC Source				----------		
b1 Bulb Predictions						
b1 Bulb measurements						
b2 Bulb Predictions						
b2 Bulb measurements						

Table#4

	Voltage	Current	Power	Brightness	$R_{bulb} = V_{bulb} / I_{bulb}$	$R_{bulb} = P / I^2$
DC Source				----------		
b1 Bulb predictions						
b2 Bulb predictions						
b3 Bulb predictions						
b1 Bulb measurements						
b2 Bulb measurements						
b3 Bulb measurements						