Yanbu University College

Preparatory Physical Science (PHSC-001)
Lab. Exercise No. 7

Name: _____

Student's ID _____, Section_____, Date_____

Study Series and Parallel Circuits

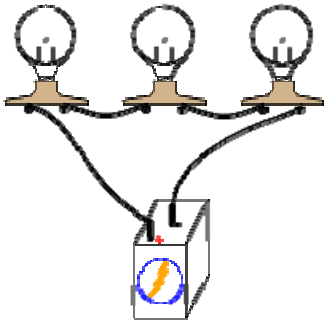
Object:

- To study current flow in series and parallel circuits.
- To study voltages in series and parallel circuits.

Equipment:

3 Lamp sockets, 3 Filament lamps, 12 V / 0.1 A, Multimeter (figure 2), Connection box , Connecting cord, l = 500 mm, blue, Connecting cord, l = 500 mm, red, Power supply, 12 V

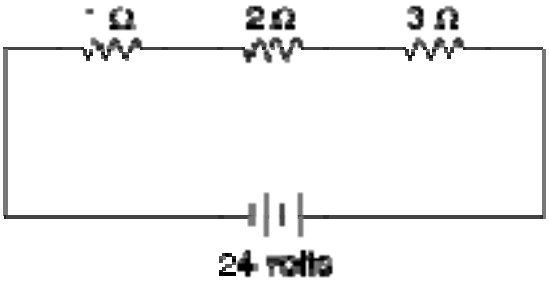
Series Circuit:

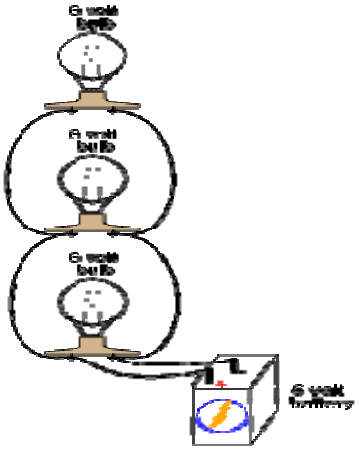


In a series circuit the resistors are connected end-to-end such that the current is the same through each resistor; the current has only one path available. The voltage drop across each resistor depends on the resistor value. For a series circuit the total equivalent resistance, R_T, is:

$$R_T = R_1 + R_2 + \cdots R_n$$

$$R_T = \sum_{i=1}^{n} R_i$$



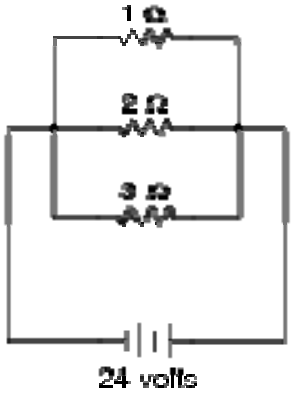


Parallel Circuit:

Resistors are said to be in parallel when they are connected at both ends, such that the potential difference applied across the combination is the same as the potential difference applied across an individual resistor. The current through each resistor depends on the resistor value. The current has more than one path available, and takes all available paths. For a parallel circuit the total equivalent resistance, R_T, is:

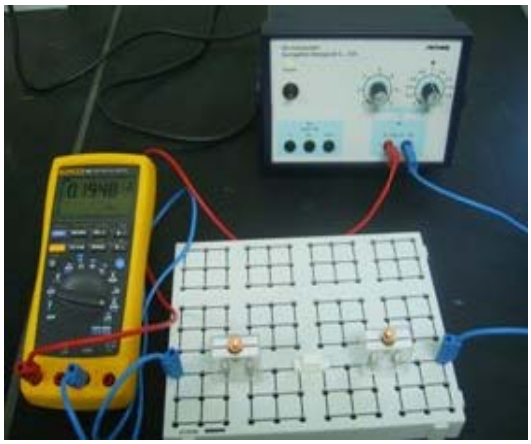
$$\frac{1}{R_T} = \frac{1}{R_1} + \frac{1}{R_2} + \cdots \frac{1}{R_n}$$

$$\frac{1}{R_T} = \sum_{i=1}^{n} \frac{1}{R_i}$$



Procedure:

Series Circuit



- Construct a series circuit with the power supply (unplugged from outlet) and two lamp sockets with filament lamps as shown in the fig. Connected in the appropriate places. Use connection box. Select the voltmeter function of multi meter; connect it to your circuit so that it will measure the potential difference. When a current is flowing. Select the ammeter function on the multi meter; insert it into your circuit.
- Get instructor approval of your circuit!
- Plug in the power supply. Adjust the power supply until the potential difference across the filament lamp is 2.0V; this is the same as the potential difference across the power supply.
- Record the current (A) and the voltage (V). Repeat this process in 1.0V increments up to 4.0 V.
- With the voltage across the power supply set at 4.0V, disconnect the voltmeter. Maintaining the same orientation of the leads, measure the potential difference across each resistor.
- Add these potential differences. Does equal 4.0V?
- Turn off, and then disconnect, the power supply from the circuit. Measure and record the resistance of the circuit, R_T, with the ohmmeter function of the multi meter.

Observations:

Voltage supplied = V=_____ volts

Current through the circuit = I=_____ ampere

Filament Lamp	Voltage across each filament lamp (volts)	Current through each filament lamp (amp)
1	V_1 = _____	I_1 = _____
2	V_2 = _____	I_2 = _____

Result:

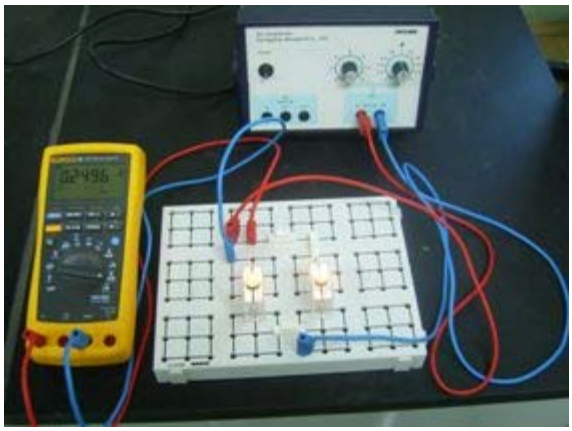
$V_1 + V_2$ = _____ volt

Verify: $I_1 = I_2 = I$

Verify: $V_1 + V_2 = V$

Verified: _____ [Yes/No]

Parallel Circuit:



- Construct a parallel circuit (Fig. 7) with the power supply (unplugged from outlet) and two lamp socket with filament lamp, see figure
- There is variety of ways to do this.
- Get instructor approval of your circuit!
- Connect the multi meter to the circuit. Plug in the power supply and increase the power until the potential difference is 2.0V. Record the voltage and current.
- Measure and record the potential difference across each resistor.

- As you increase the potential difference, in 1.0V up to 4.0V, measure and record the voltage and current.

Observations:

- Voltage supplied = V=_____ volt
- Current through the circuit = I=_____ ampere

Filament Lamp	Voltage across each filament lamp (volts)	Current through each filament lamp (amp)
1	V_1=_____	I_1=_____
2	V_2=_____	I_2 =_____

Result:
$I_1 + I_2$ = _____ amp

Verify: $I_1 + I_2 = I$

Verify: $V_1 = V_2 = V$

Verified: _____ [Yes/No]

Review Questions

Q 1. Are the circuits in houses wired in series and/or parallel? What evidence do you have for your answer?

Q 2. Distinguish between A.C and D.C

Q 3. The power in an electric circuit is given by the equation P = IV. Use Ohm's law to show that power can be expressed by the equation $P = I^2R$

End of the lab exercise