**Series and Parallel CPU LAB**

**MARKING RUBRIC /15 marks**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | **0-1** | **2** | **3** | **4** | **5** |
| **Observations** | * Most data is not represented or is not accurate
* Several tables not completed
 | * Accurate representation of the data in few tables – many errors
 | * Accurate representation of the data in most tables, but more than 1 error
 | * Accurate representation of the data in most tables except for 1 error
* All units given correctly
 | * Accurate and complete representation of the data in all tables
* All units given correctly
* Numbers rounded to nearest whole
 |
| **Analysis** | * Several questions are not answered
* Answers show little/no understanding of the key concepts demonstrated in the lab
 | * Answers to questions are incomplete
* Analysis is inconsistent and often incorrect
 | * Most questions are answered briefly
* Analysis is general with several errors
 | * Most questions are answered in complete sentences
* Analysis is mostly correct and thoughtful
 | * Questions are answered thoroughly and in complete sentences
* Analysis is insightful and correct
 |
| **Conclusion**“0”no conclusion included | * The conclusion shows little effort and reflection on the lab. An understanding of the lab has not been demonstrated.
 | * A statement of the results is incomplete with little reflection on the lab. Conclusion is inconsistent.
 | * A statement of the results of the lab indicates a satisfactory understanding of the topic. Few or no observations from lab not used in the analysis.
 | * Accurate statement of the results of the lab indicates a good understanding of the topic. Some observations from the lab were used in the analysis.
 | * Accurate statement of the results of the lab indicates a very good understanding of the topic. Specific observations and examples from the lab procedure were used throughout the analysis.
 |

 **Series and Parallel Online LAB**

In this activity, you will be using an electric circuit program to study the ideas of series and parallel in an electric circuit. **Website:** *phet.colorado.edu/en/simulation/circuit-construction-kit-dc*

**PURPOSE:**

* To construct a series and a parallel circuit
* To correctly place a voltmeter and ammeter into a circuit
* To measure the current and voltage in a circuit
* To develop a relationship between the voltage and current in a circuit

# M:\Photos\iPhone\IMG_1850.JPGData Collection and Analysis: *Series Circuits*

**1.** Open the circuits program.

**2.** Construct a *series circuit* (as shown here) containing:

 • 120 v battery (use two 60 V batteries)

 • three 20 Ω resistors connected in *series* to the battery

 • a switch to control the current leaving the battery

 • meters (anmeters and a voltmeter) to measure the voltage and current through each resistor and the battery.

**3.** Close the switch and turn on the circuit. Record your measurements of the voltage and current in each device in the table below.

|  |  |  |
| --- | --- | --- |
|  | **Voltage (V)** | **Current (A)** |
| **Battery (total)** |  |  |
| **Resistor #1** (20 Ω) |  |  |
| **Resistor #2** (20 Ω) |  |  |
| **Resistor #3** (20 Ω) |  |  |

**3a.** How do the *currents* through each resistor in the series circuit compare with each other and the current from the battery? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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**3b.** Calculate the *total* voltages *lost* across all resistors added in the circuit.

 V Total = V1 + V2+ V3=\_\_\_\_ +\_\_\_\_\_+ \_\_\_\_=\_\_\_\_\_\_\_

**3c.** What is the *total* voltage *provided* by the battery in the circuit: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**3d.** What do you observe about the TOTAL *voltages lost* and *voltage provided by the battery* in a series

 circuit?\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**4.** Change the values of the resistors to **20Ω, 40Ω and 60Ω**. Close the switch and turn on the circuit. Record your measurements of the voltage and current in each device in the table below.

|  |  |  |
| --- | --- | --- |
|  | **Voltage (V)** | **Current (A)** |
| **Battery (total)** |  |  |
| **Resistor #1** (20 Ω) |  |  |
| **Resistor #2** (40 Ω) |  |  |
| **Resistor #3** (60 Ω) |  |  |

**5a.** How do currents compare through each resistor in series?

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**5b.** What do you observe about the TOTAL *voltages lost* and *voltage provided* in this series circuit?
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**5.c.** How does *increasing the resistance* of resistors in series affect the *voltage lost* across each resistor?

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5.d. How does increasing the overall resistance in the series circuit affect the current? Compare both tables of data completed for the series circuits. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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**Data Collection and Analysis: *Parallel Circuits***

**1.** Construct a parallel circuit (as shown here) containing:

 • 120 v battery

 • three 20 Ω resistors, each connected in *parallel* to each other

 • a switch to control the current leaving the battery

 • meters to measure the voltage and current on the battery and each resistor

**2.** Close the switch and turn on the circuit. Record your measurements of the voltage and current in each device in the table on the next page.

***Parallel Circuit:***

|  |  |  |
| --- | --- | --- |
|  | **Voltage (V)** | **Current (A)** |
| **Battery (total)** |  |  |
| **Resistor #1** (20 Ω) |  |  |
| **Resistor #2** (20 Ω) |  |  |
| **Resistor #3** (20 Ω) |  |  |

**2a.** What do you notice about the *currents in each branch of the resistors* connected in parallel compared to the *total current through the battery*? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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**2b.** Refer to table above. Why are the currents through each branch of the parallel circuit the same value?

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**2c.** How do the *voltages lost* across each resistor in the parallel circuit compare to the *total* *voltage provided* by the battery?\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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**3.** Change the values of the resistors to 10Ω, 20Ω and 30Ω. Record your measurements of the voltage and current in each device in the table below.

|  |  |  |
| --- | --- | --- |
|  | **Voltage (V)** | **Current (A)** |
| Battery (Total) |  |  |
| **Resistor #1** (10 Ω) |  |  |
| **Resistor #2** (20 Ω) |  |  |
| **Resistor #3** (30 Ω) |  |  |

**3a.** What relationship can you see between the *current* in each branch of a parallel circuit and the *amount of resistance* in each branch? Does current increase or decrease as resistance increases?

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**3b.** How does the total current *leaving the battery* compare to the total of the currentsthrough *each branch* of the parallel circuit?\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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**3c.** How do the *voltages lost* across each resistor in the parallel circuit compare to the *total voltage provided* by the battery?

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**Conclusion: *Series and Parallel Circuits***

Summarize, in a brief paragraph, what relationships you have learned from this simulation. What happens to voltage in a series circuit as it is lost at each load? What happens to current as it passes through a series circuit compared to the current from the source? How does voltages lost at each load in a parallel circuit compare to the total voltage from the source? What happens to current when it passes into a junction in a parallel circuit and how does it compare to the total current from the source? How does increasing resistance of resistors influence current and/or voltage in a series vs a parallel circuit? ***USE SPECIFIC OBSERVATIONS FROM THE LAB!!! /5 marks!***