PE
6

Series and Parallel Circuits

(Updated 1/30/2009)

A Practical Exercise Name:_____ Section: _____

I. Purpose.

1. Review the calculation of total resistance for resistive elements connected in series and in parallel.
2. Review the calculation of total power supplied and total power dissipated.
3. Review the construction of a circuit from a schematic with a voltage point source.
4. Introduce Kirchhoff's voltage law, Kirchhoff's current law, and Ohm's law in analysis of DC series/parallel circuits.
5. Introduce voltage divider rule and current divider rule in the analysis of DC series/parallel circuits.

II. Equipment.

Agilent 34401A Digital Multimeter (DMM)
Agilent E3620A Dual DC Power Supply
Quad Board and Test Leads
220-Ω resistor
560-Ω resistor
1000-Ω resistor
1500-Ω resistor

III. Preparation.

Review procedures for measuring resistance, voltage, and current.

IV. Lab Procedure.

You must **read** and complete each step.

Step One:

☐ On a QUAD board construct the DC series/parallel circuit in Figure 1. Remember to arrange your circuit so that it will be easy to measure current down each branch.

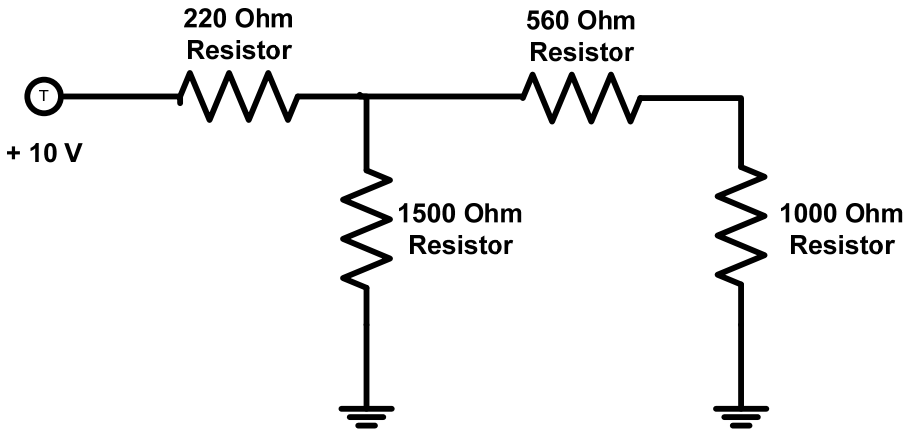

Figure 1

Step Two: Resistors in series and parallel.

☐ Measure the resistance of each resistor

	Measured resistor values		**Measured resistor values**
220-Ω		**560-Ω**	
1500-Ω		**1000-Ω**	

☐ Using the measured values of the resistors, calculate the total resistance, $\boldsymbol{R_T}$, as seen by the source.

$$\boldsymbol{R_T} = \_\_\_\_\_$$

Step Three: DC series/parallel circuit analysis.

☐ Using Kirchhoff's current law, Ohm's law, and current divider rule calculate the currents indicated in figure 2. Use your measured resistances for this calculation.

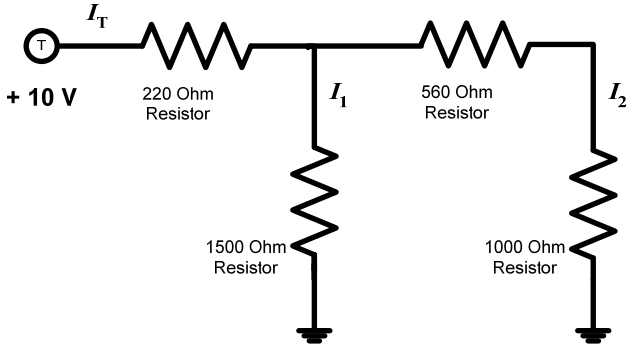

Figure 2

	Calculated current values
$\boldsymbol{I_T}$	
$\boldsymbol{I_1}$	
$\boldsymbol{I_2}$	

☐ Draw on figure 2 the direction of the conventional current flow and indicate the voltage polarities across the resistors and the DC voltage source.

From your observation of this DC series/parallel circuit will the voltage across 1000-Ω resistor and 1500-Ω resistor be the same or different? _____

Why? _____

_____

Step Four: Verify DC series/parallel circuit analysis.

☐ Use the DMM to measure the currents: $\boldsymbol{I_T}$, $\boldsymbol{I_1}$, and $\boldsymbol{I_2}$.

	Measured current values
$\boldsymbol{I_T}$	
$\boldsymbol{I_1}$	
$\boldsymbol{I_2}$	

☐ How do these measured currents compare with your calculated currents? _____

☐ Use your <u>measured</u> CURRENT and RESISTANCE values to predict the voltage drop across each resistor.

☐ Use the DMM to measure the voltage drop across each resistor.

	Predicted voltage values	**Measured voltage values**
$\mathbf{V_{220\text{-}\Omega}}$		
$\mathbf{V_{560\text{-}\Omega}}$		
$\mathbf{V_{1000\text{-}\Omega}}$		
$\mathbf{V_{1500\text{-}\Omega}}$		

Step Five: Voltage Divider Rule.

☐ Use the voltage divider rule to verify your measured $\mathbf{V_{1000\text{-}\Omega}}$.

$\mathbf{V_{1000\text{-}\Omega}}$ = _____

Step Six: Compute the real power (**P = I V, P = I^2 R,** and **P = V^2 / R**).

☐ Use your measured current, voltage, and resistor values to compute the power supplied by the DC power source and the total power dissipated by the 220-Ω, 560-Ω, 1000-Ω, and 1500-Ω resistors.

	Power (watts)
DC Power Supply	
220-Ω resistor	
1500-Ω resistor	
560-Ω resistor	
1000-Ω resistor	

$$\Sigma\ \text{Power}_{in} = \Sigma\ \text{Power}_{out}$$

$$\Sigma\ \_\_\_\_\_ = \Sigma \_\_\_\_\_$$

Does the total power supplied equal the total power dissipated by the resistors? _____