

## 20.2

## Analysis of Circuits



Question: How do you analyze network circuits?

### 1 Determining the resistance of each resistor

Table 1: Measured resistance values

	R1	R2	R3	R4
Resistance ( $\Omega$ )				

### 2 Building a network circuit

Record the data in the table.

### 3 Analyzing the circuit

Table 2: Voltage and current measurements

	Battery (total circuit)	R1	R2	R3
Voltage (volts)				
Current (amps)				

- a. Which of the two resistors is connected in parallel? \_\_\_\_\_
- b. Which resistor is in series with the other two? \_\_\_\_\_
- c. How does the voltage across the parallel resistors ( $R_2$  and  $R_3$ ) compare?

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- d. How does the voltage across the parallel resistors relate to what you learned about voltages in a parallel circuit in the previous Investigation?

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- e. Voltage is the measure of the amount of energy carried by the current in a circuit. Trace the path of the current from the positive end of the battery, through the circuit, to the negative end of the battery. There are two possible paths because of the parallel part of the circuit but each path will only pass through two of the resistors. Does the amount of energy lost through the resistors equal the amount of energy supplied by the battery? Is this the case for each possible path? Explain.

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- f. How does the current flowing through  $R_1$  compare with the current through  $R_2$ ?
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- g. How does the current coming out of the battery compare with the sum of the currents flowing through  $R_2$  and  $R_3$ ? Explain this relationship.
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- h. Use what you know about series and parallel circuits to calculate the theoretical total resistance of the circuit.
- i. Now calculate the total resistance of the circuit using Ohm's law, the battery voltage, and the total circuit current you measured.
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- j. How does the total resistance calculated using Ohm's law compare with the theoretical total resistance found above?
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**4****Predicting the effect of changing a resistor**

- a. Replace the 10-ohm resistor ( $R_3$ ) with the 20-ohm resistor ( $R_4$ ). Use what you have learned about network circuits to predict the total circuit resistance and total circuit current. Show the process you used to make your predictions.
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- b. Measure the voltage across the battery and each resistor and the total current in the circuit. Use Ohm's law to find the total circuit resistance. You will need to make a data table similar to Table 2.

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c. How did the predicted values compare with the measured ones?

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**5**

**A circuit puzzle**

a. When bulb B is disconnected, does bulb A get dimmer, brighter, or stay the same?

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b. When bulb B is disconnected, does bulb C get dimmer, brighter, or stay the same?

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c. Use what you know about series and parallel circuits to propose an explanation for what you observed.

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**6**

**Challenge: Analyze a four-resistor network circuit**

a. Build the circuit shown in the diagram at right.

b. Use what you have learned about network circuits to predict the total circuit resistance and current. Show the process you used to make your predictions.

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c. Use the meter to measure the voltage across the battery and each resistor and the total circuit current. Use Ohm's law to find the total circuit resistance.

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d. How did the predicted values compare with the measured ones?

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