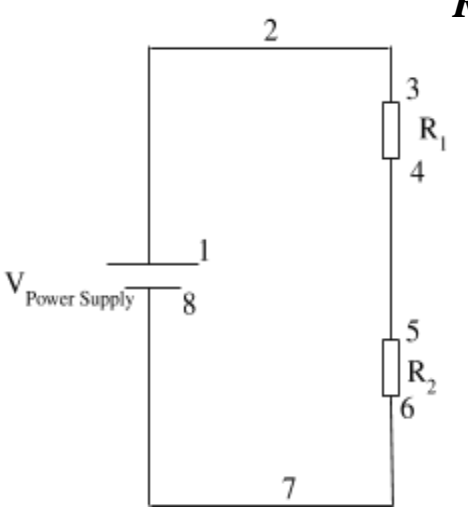
Resistors in Series



Answer the questions in a section before taking the data on that section. Do not erase unless you made a mathematical mistake.

Sketch the arrangement that would represent the circuit above. Set up the circuit and get it approved before you turn on the power supply. We will assume that there is no resistance in the wires, only in the resistors.

Notes:

1. In order to measure the potential difference between two points, connect the voltmeter to the each point. Make sure the positive end of the voltmeter is closer to the positive end of the power supply.
2. In order to measure the current through a point, place the ammeter in the circuit as a wire. Again, make sure the positive end of the ammeter is closer to the positive side of the power supply than the negative end of the ammeter.

On the circuit above, eight points have been identified and numbered. Use these positions as reference to respond to the following:

A. Points 1 and 8 are the ends of the power supply. Put a + next to the positive end of the power supply and a – next to the negative end of the power supply. The potential difference between the two points is $V_{Power\ Supply}$ as shown.

i. On the diagram above, show the direction of the current at points 2 and 7.
ii. How would these currents compare? Explain your reasoning.

B. Points 3 and 4 are on the opposite ends of R_1.

i. Which has the higher electric potential? Explain your reasoning.
ii. Place a + next to the point that has the higher potential and a – next to the lower potential. Label this potential difference V_1.
iii. How does the current through point 4 compare to the current through point 2? Explain your reasoning.
iv. How does the potential difference between points 3 and 4 compare to the potential difference between points 1 and 8? Explain your reasoning.

C. Points 5 and 6 are on the opposite ends of R_2.

i. Which has the higher electric potential? Explain your reasoning.

ii. Place a + next to the point that has the higher potential and a – next to the lower potential. Label this potential difference V_2.

iii. How does the current through point 5 compare to the current through point 7? Explain your reasoning.

iv. How does the potential difference between points 5 and 6 compare to the potential difference between points 1 and 8? Explain your reasoning.

D. On the circuit diagram, color-code the wires so all parts of a wire that have the same potential are the same color. If there is a different potential, make that wire a different color.

i. How does the electric potential at point 3 compare to the electric potential at point 1? Explain your reasoning.

ii. How does the electric potential at point 4 compare to the electric potential at point 5? Explain your reasoning.

iii. How does the electric potential at point 6 compare to the electric potential at point 8? Explain your reasoning.

iv. How does the potential difference between points 1 and 8 compare to the potential difference between 3 and 6? Explain your reasoning.

E. The power supply does not "see" two resistors. It only "sees" an effective resistance for the combination.

i. What is the potential difference across the effective resistor? How did you arrive at this number?

ii. How does this potential difference compare to the potential difference across the power supply?
Explain your reasoning.

iii. What is the current through the effective resistor?

iv. What is the effective resistance of the series combination?

F. Another resistor is added in series with the original two. Draw this circuit diagram.

i. What would happen to the potential difference across the combination?

ii. What would happen to the current through the combination?

iii. What would happen to the potential difference across the individual resistors?

iv. How could you calculate the effective resistance of the three resistor combination without measuring any potential differences?

G. Write a general equation to find the effective resistance for any number of resistors connected in series.