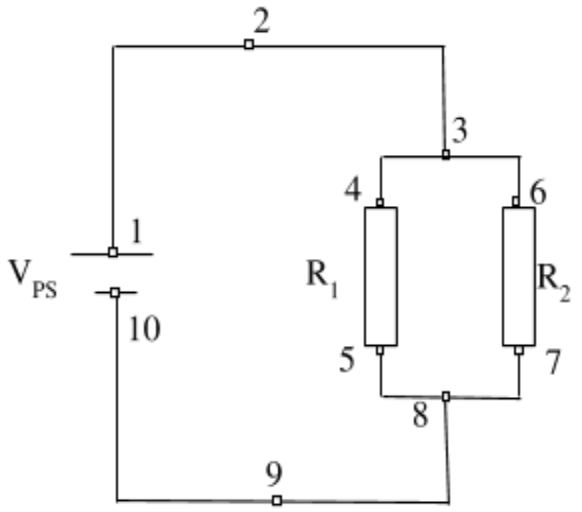
Resistors in Parallel



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 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, ten points have been identified and numbered. Use these positions as reference to respond to the following:

A. Points 1 and 10 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_{PS} as shown. 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. What points will have the same electric potential as point 1? Explain your reasoning.
ii. What points will have the same electric potential as point 10? Explain your reasoning.
iii. Points 4 and 5 are on the opposite ends of R_1. Label the potential difference between these points V_1. Points 6 and 7 are on the opposite ends of R_2. Label the potential difference between these points V_2.
iv. How does V_1 compare to the potential difference between points 3 and 8? Explain your reasoning.

v. How does V_2 compare to the potential difference between points 3 and 8? Explain your reasoning.
vi. How does V_1 compare to V_2? Explain your reasoning.
vii. How does V_1 compare to the potential difference between points 1 and 10? Explain your reasoning.

B. Point 2 is a point in the wire that is attached to the positive end of the power supply. Indicate the direction for the current at points 2 and 9. Label the current at point 2 I_B to represent the current out of the power supply.

i. How does the current through point 2 compare to the current through point 9?
ii. Since the colors on your resistors are different, the resistances are different. How should the current through R_1 compare to the current through R_2? (Call these currents I_1 and I_2.) Explain your reasoning.
iii. How should the current I_B compare to I_1?
iv. How should the current I_B compare to I_2?
v. Describe the relationship between I_1, I_2, and I_B in words.
vi. Rewrite the relationship as a symbolic equation.

C. i. What is the value for R_1? Explain your reasoning.
ii. What is the value for R_2? Explain your reasoning.
iii. What is the equivalent resistance between points 3 and 8? (Call this R_{Eq})
iv. How does R_1 compare to R_{Eq}?
v. How does R_2 compare to R_{Eq}?

D. i. Rewrite your current equation using V_1, V_2, V_{PS}, R_1, R_2, and R_{Eq}.
ii. What is the relationship between V_1, V_2, and V_{PS}?
iii. Rewrite your equation to only include R's. This is your general equation for adding resistors in parallel.

E. Write a general statement about the following relationships in parallel circuits:

i. potential difference across each branch.
ii. the current that comes into a junction and the current that leaves the junction. (Current coming into point 3 and the current leaving point 3.)
iii. the equivalent resistance of a circuit as resistors are added in parallel.