

Kirchhoff's Rules

Junction Rule
 Total _____ a junction must _____ the total current _____ of a junction

Loop Rule
 For a _____-circuit loop, the _____ of all the potential _____ - total of all potential _____ = 0
 (or the total voltage of a loop is zero)

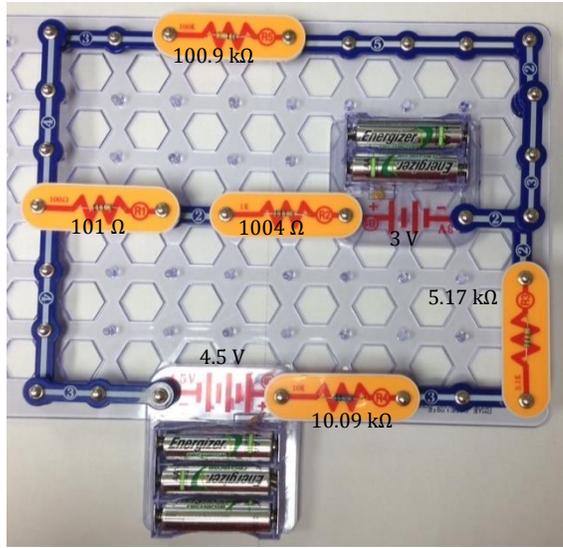
Reasoning Strategy

1. Draw the _____ in each branch of the circuit (flows out of positive terminal of battery). Choose any _____ . If you are wrong you will get a _____ current.
2. Mark each _____ with a _____ and _____ signs at opposite ends to show _____ drop. (Current flows from + to - through a resistor)
3. If the current _____ the element at +, voltage _____
4. If the current _____ the element at -, voltage _____
5. Apply _____ rule and _____ rule to get as many independent _____ as there are _____.
6. Solve the _____ of equations.

Find the current through the circuit



Find the currents through each element.



Homework

1. Can all of the currents going into the junction in Figure 1 be positive? Explain.
2. Apply the junction rule to junction b in Figure 2. Is any new information gained by applying the junction rule at e? (In the figure, each emf is represented by script E.)
3. Apply the loop rule to loop afedcba in Figure 2.
4. Apply the loop rule to loop abcdefgha in Figure 3. (OpenStax 21.31) $-I_2R_2 + E_1 - I_2r_1 + I_3R_3 + I_3r_2 - E_2 = 0$
5. Apply the loop rule to loop aedcba in Figure 3. (OpenStax 21.32) $I_1R_1 + I_2r_1 - E_1 + I_2R_2 = 0$
6. Apply the junction rule at point a in Figure 4. (OpenStax 21.35) $I_3 = I_1 + I_2$
7. Apply the loop rule to loop abcdefghija in Figure 4. (OpenStax 21.36) $-I_1R_1 + E_1 - I_1r_1 - I_1R_5 - I_3r_4 - E_4 - I_3r_3 + E_3 - I_3R_3 = 0$
8. Solve the circuit in Figure 3. Use the loop abcdefgha for one of your equations. (OpenStax 21.38) $I_1 = 4.75 \text{ A}, I_2 = -3.5 \text{ A}, I_3 = 8.25 \text{ A}$

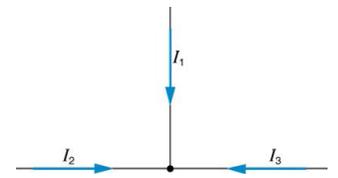


Figure 1

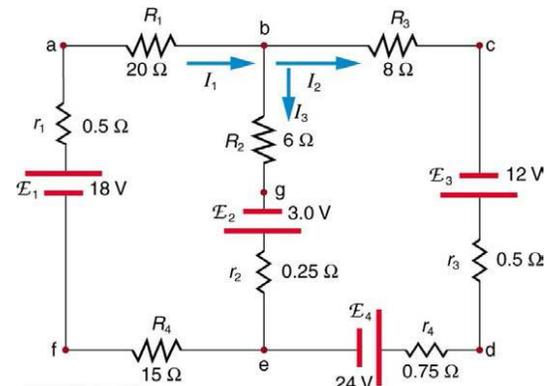


Figure 2

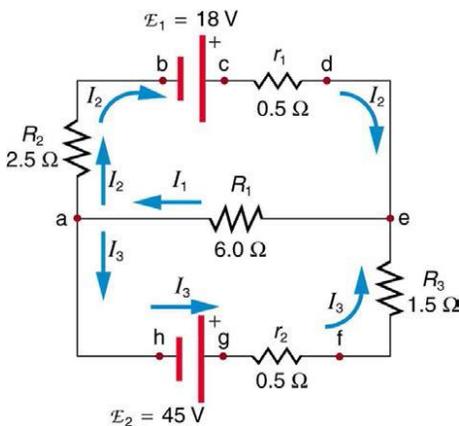


Figure 3

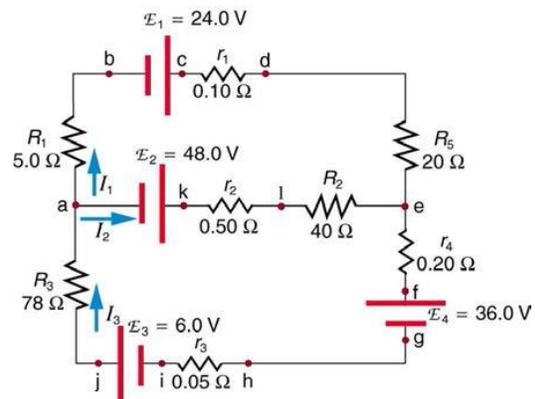


Figure 4