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PHYS-2B, section 34945, Spring 2020

INSTRUCTOR
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California State University Fresno

Ohm's Law (Homework)

Current Score

QUESTION	1	2	3	4	5	6	7	8	9	10	11	12
POINTS	2/2	2/2	4/4	8/8	2/2	2/2	4/4	2/5	6/6	8/8	0/2	–/1

TOTAL SCORE

40/46	87.0%

Due Date Past Due

SAT, FEB 22, 2020

11:59 PM PST

Request Extension

Assignment Submission & Scoring

Assignment Submission

For this assignment, you submit answers by question parts. The number of submissions remaining for each question part only changes if you submit or change the answer.

Assignment Scoring

Your last submission is used for your score.

The due date for this assignment has passed.

Your work can be viewed below, but no changes can be made.

Important! Before you view the answer key, decide whether or not you plan to request an extension. Your Instructor may not grant you an extension if you have viewed the answer key. Automatic extensions are not granted if you have viewed the answer key.

Request Extension

1. 2/2 points Previous Answers SERCP11 17.2.OP.001.

My Notes Ask Your Teacher

A copper wire carries a current of 87.4 mA.

(a) Find the number of electrons that flow past a given point in the wire in 10.6 minutes.

3.47e20 ✔ 3.47e+20 electrons

(b) In what direction do the electrons travel with respect to the current?

- same direction
- opposite direction (selected)
- The magnitude is zero.

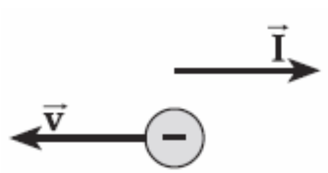
✔

Solution or Explanation

(a) The charge that moves past the cross section is $\Delta Q = I(\Delta t)$, and the number of electrons is

$$n = \frac{\Delta Q}{|e|} = \frac{I(\Delta t)}{|e|}$$
$$= \frac{(87.4 \times 10^{-3}\ \text{C/s})[(10.6\ \text{min})(60.0\ \text{s/min})]}{1.60 \times 10^{-19}\ \text{C}} = 3.47 \times 10^{20}\ \text{electrons.}$$

(b) The negatively charged electrons move in the direction opposite to the conventional current flow.



Need Help? Read It

2. 2/2 points Previous Answers **SERCP11 17.2.P.002.**

My Notes Ask Your Teacher

A copper wire has a circular cross section with a radius of 1.76 mm.

HINT

(a) If the wire carries a current of 3.18 A, find the drift speed (in m/s) of electrons in the wire. (Take the density of mobile charge carriers in copper to be $n = 1.10 \times 10^{29}$ electrons/m^3.)

1.86e-5 ✓ 1.85e-05 The drift speed of an electron in a wire is very small, typically about one-billionth of its random thermal speed. m/s

(b) For the same wire size and current, find the drift speed (in m/s) of electrons if the wire is made of aluminum with $n = 2.11 \times 10^{29}$ electrons/m^3.

9.68e-6 ✓ 9.67e-06 m/s

Solution or Explanation

Note: We are displaying rounded intermediate values for practical purposes. However, the calculations are made using the unrounded values.

The relationship between electrical current I in the wire and the drift speed v_d of the current carriers is

$$I = nqv_dA$$

where n is the number of charge carriers per m^3 and $q = +e = 1.60 \times 10^{-19}$ C is the magnitude of charge carried by each charge carrier. The wire's cross-sectional area is $A = \pi r^2 = \pi(1.76 \times 10^{-3}\text{ m})^2 = 9.73 \times 10^{-6}\text{ m}^2$.

(a) Solve for the drift speed in copper from the current expression $I = nqv_dA$.

$$v_d = \frac{I}{nqA} = \frac{3.18\text{ A}}{(1.10 \times 10^{29}\text{ electrons/m}^3)(1.60 \times 10^{-19}\text{ C})(9.73 \times 10^{-6}\text{ m}^2)}$$
$$= 1.85 \times 10^{-5}\text{ m/s}$$

(b) Similarly, solve for the drift speed in aluminum using the same expression with the new value for n.

$$v_d = \frac{I}{nqA} = \frac{3.18\text{ A}}{(2.11 \times 10^{29}\text{ electrons/m}^3)(1.60 \times 10^{-19}\text{ C})(9.73 \times 10^{-6}\text{ m}^2)}$$
$$= 9.67 \times 10^{-6}\text{ m/s}$$

Need Help? Read It Watch It

3. 4/4 points Previous Answers **SERCP11 18.3.OP.006.**

My Notes Ask Your Teacher

(a) Three 7.30 Ω resistors are connected in *series* to a 22.0 V battery.

What is the equivalent resistance (in Ω) of the circuit?

21.90 ✓ 21.9 Ω

What is the current (in A) in each resistor?

1 ✓ 1 A

(b) Three other 7.30 Ω resistors are all connected in *parallel* across a second 22.0 V battery.

What is the equivalent resistance (in Ω) of this circuit?

2.43 ✓ 2.43 Ω

What is the current (in A) in each resistor in this circuit?

3.01 ✓ 3.01 A

Solution or Explanation

(a) The equivalent resistance of resistors in series is given by the following.

$$R_{\text{eq, series}} = R_1 + R_2 + R_3 + \ldots$$

Let each of the resistors have resistance R = 7.30 Ω. The equivalent resistance of this circuit is then

$$R_{\text{eq, series}} = R + R + R = 3R = 3(7.30\ \Omega) = 21.9\ \Omega.$$

The potential difference across the terminals of the battery is ΔV = 22.0 V. The magnitude of this potential difference is equal to the potential difference across all three resistors in series. Therefore, from Ohm's law, the current through each resistor is

$$I = \frac{\Delta V}{R_{\text{eq, series}}} = \frac{22.0\ \text{V}}{21.9\ \Omega} = 1.00\ \text{A}.$$

(b) The equivalent resistance of three resistors all in parallel with each other is found by the following.

$$\frac{1}{R_{\text{eq, parallel}}} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} + \ldots$$

For this second circuit, we have the following.

$$\frac{1}{R_{\text{eq, parallel}}} = \frac{1}{R} + \frac{1}{R} + \frac{1}{R} = \frac{3}{R}$$

$$R_{\text{eq, parallel}} = \frac{R}{3} = \frac{7.30\ \Omega}{3} = 2.43\ \Omega$$

If each resistor is in parallel with the battery, then the potential difference across each resistor is the same as the potential difference across the battery. So, from Ohm's law, the current in each resistor is

$$I = \frac{\Delta V}{R} = \frac{22.0\ \text{V}}{7.30\ \Omega} = 3.01\ \text{A}.$$

Need Help? Read It

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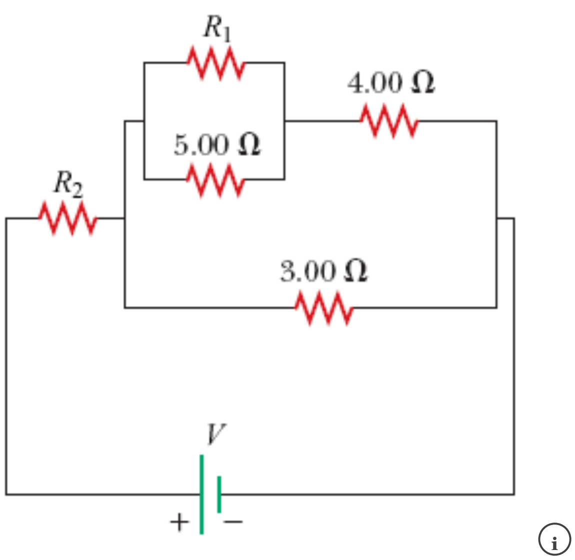
4. 8/8 points Previous Answers **SERCP11 18.3.OP.010.**

My Notes Ask Your Teacher

Use the exact values you enter to make later calculations.

The figure below shows a battery connected to a circuit. The potential difference across the battery and the resistance of each resistor is given in the figure. (Assume R_1 = 12.0 Ω, R_2 = 1.20 Ω, and V = 6.00 V.)



(a) What is the equivalent resistance (in Ω) of R_1 and the 5.00 Ω resistor?

3.57 ✓ 3.57 Ω

(b) Using the result from part (a), what is the equivalent resistance (in Ω) of R_1, the 5.00 Ω resistor, and the 4.00 Ω resistor?

7.57 ✓ 7.57 Ω

(c) Using the result from part (b), what is the equivalent resistance (in Ω) of R_1, the 5.00 Ω resistor, the 4.00 Ω resistor, and the 3.00 Ω resistor?

2.13 ✓ 2.13 Ω

(d) Using the result from part (c), what is the equivalent resistance (in Ω) of the entire circuit?

3.33 ✓ 3.33 Ω

(e) What is the current (in A) through the battery (equivalently, the conventional current that exits the positive terminal of the battery and enters the R_2)?

1.80 ✓ 1.8 A

(f) What is the magnitude of the potential difference (in V) across R_2?

2.16 ✓ 2.16 V

(g) Using the result from part (f) and the battery's potential difference, what is the magnitude of the potential difference (in V) across the 3.00 Ω resistor?

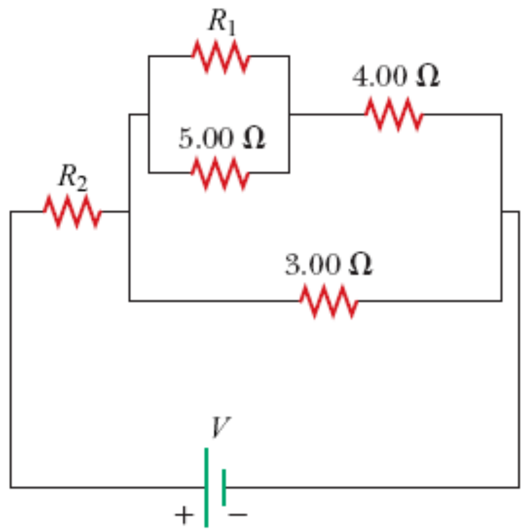
3.84 ✓ 3.84 V

(h) What is the current (in A) in the 3.00 Ω resistor?

1.28 ✓ 1.28 A

Solution or Explanation

Note: We are displaying rounded intermediate values for practical purposes. However, the calculations are made using the unrounded values.



(a) The equivalent resistance of this first parallel combination is

$$\frac{1}{R_{p1}} = \frac{1}{12.0\ \Omega} + \frac{1}{5.00\ \Omega} \text{ or } R_{p1} = 3.53\ \Omega.$$

(b) For this series combination,

$$R_{\text{upper}} = R_{p1} + 4.00\ \Omega = 7.53\ \Omega.$$

(c) For the second parallel combination,

$$\frac{1}{R_{p2}} = \frac{1}{R_{\text{upper}}} + \frac{1}{3.00\ \Omega} = \frac{1}{7.53\ \Omega} + \frac{1}{3.00\ \Omega} \text{ or } R_{p2} = 2.15\ \Omega.$$

(d) For the second series combination (and hence the entire resistor network),

$$R_{\text{total}} = 1.20\ \Omega + R_{p2} = 1.20\ \Omega + 2.15\ \Omega = 3.35\ \Omega.$$

(e) The total current supplied by the battery is

$$I_{\text{total}} = \frac{\Delta V}{R_{\text{total}}} = \frac{6.00\ \text{V}}{3.35\ \Omega} = 1.79\ \text{A}.$$

(f) The potential drop across R_2 is

$$\Delta V_2 = R_2 I_{\text{total}} = (1.20\ \Omega)(1.79\ \text{A}) = 2.15\ \text{V}.$$

(g) The potential drop across the second parallel combination must be

$$\Delta V_{p2} = \Delta V - \Delta V_2 = 6.00\ \text{V} - 2.15\ \text{V} = 3.85\ \text{V}.$$

(h) So, the current through the 3.00 Ω resistor is

$$I_{\text{total}} = \frac{\Delta V_{p2}}{R_3} = \frac{3.85\text{ V}}{3.00\ \Omega} = 1.28\text{ A}$$

Need Help? Read It

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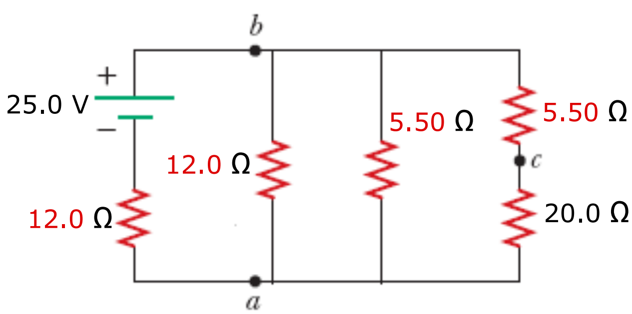
5. 2/2 points Previous Answers **SERCP11 18.3.OP.011.**

My Notes Ask Your Teacher

The figure below shows a battery connected to a circuit. The potential difference across the battery and the resistance of each resistor is given in the figure.



(a) What is the magnitude of the potential difference (in V) between points *a* and *b* in the circuit?

5.32 ✓ 5.37 V

(b) What is the current (in A) in the 20.0 Ω resistor?

.21 ✓ 0.211 A

Solution or Explanation

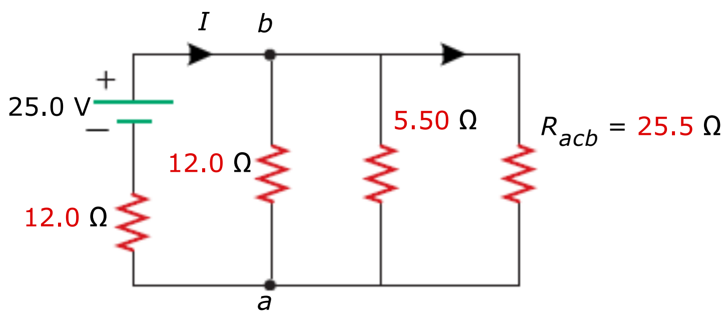
Note: We are displaying rounded intermediate values for practical purposes. However, the calculations are made using the unrounded values.

(a) To find the potential difference between *a* and *b*, we first need to find the current through the battery that is drawn by the entire circuit. This means we need to find the equivalent resistance of the entire circuit.

This will need to be done in several steps. The first step is to find the equivalent resistance of the two resistors on the right-most branch. We'll call this resistance R_{acb}. Since the two resistors are in series,

$$R_{acb} = 5.50\ \Omega + 20.0\ \Omega = 25.5\ \Omega.$$

The equivalent circuit now looks as follows.

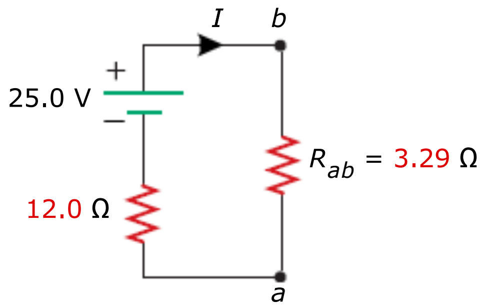


Between points a and b, we have three resistors in parallel. We'll call the equivalent resistance of these parallel branches R_{ab}. The equivalent resistance is given by the following.

$$\frac{1}{R_{ab}} = \frac{1}{12.0\ \Omega} + \frac{1}{5.50\ \Omega} + \frac{1}{25.5\ \Omega}$$

$$R_{ab} = \left(\frac{1}{12.0\ \Omega} + \frac{1}{5.50\ \Omega} + \frac{1}{25.5\ \Omega}\right)^{-1} = 3.29\ \Omega$$

Our equivalent circuit now appears as follows.



The equivalent resistance R_{ab} is now in series with the 12.0 Ω resistor just below the battery. The final equivalent resistance of the circuit is

$$R_{\text{circuit}} = 12.0\ \Omega + 3.29\ \Omega = 15.3\ \Omega.$$

We can now use this to find the current through the battery. From Ohm's law,

$$I = \frac{\Delta V_{\text{battery}}}{R_{\text{circuit}}} = \frac{25.0\ \text{V}}{15.3\ \Omega} = 1.64\ \text{A}.$$

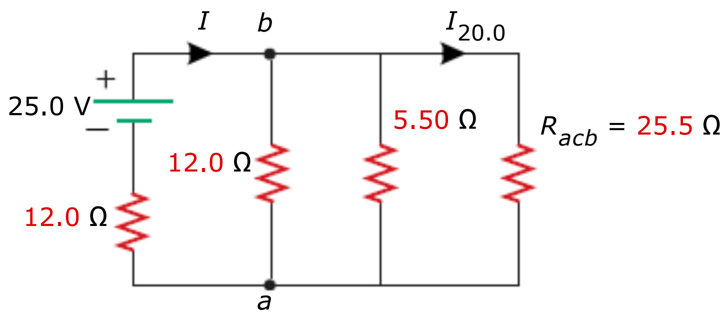
Now, let's return to the final figure, above. We know that this current through the battery is the same throughout the "single-loop" equivalent circuit. The potential difference from point a to b can then be found using this current and the resistance R_{ab} = 3.29 Ω. Therefore,

$$\Delta V_{ab} = IR_{ab} = (1.64\ \text{A})(3.29\ \Omega) = 5.37\ \text{V}.$$

Alternatively, knowing the current through the battery is the same as through the 12.0 Ω resistor below the battery, we could find the potential difference through this resistor. Knowing the potential drops as (conventional) current goes through the resistor, but rises as it goes through the battery, the potential difference between *a* and *b* can be found on the left-most branch as

$$\Delta V_{ab} = \Delta V_{\text{battery}} - I(12.0\ \Omega) = 25.0\ \text{V} - (1.64\ \text{A})(12.0\ \Omega) = 5.37\ \text{V}.$$

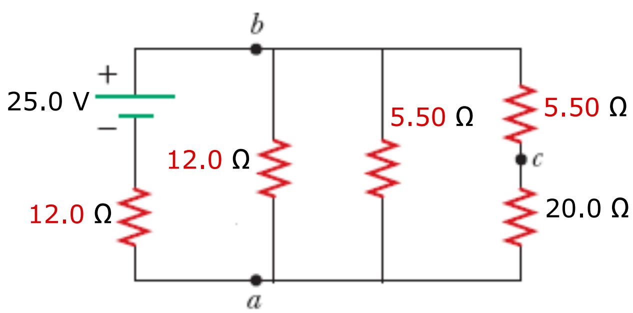
(b) Let's return to this figure.



We now know the potential difference across the right-most branch, which must be the same as ΔV_{ab}, found above to be 5.37 V. The current $I_{20.0}$ along this branch is then

$$I_{20.0} = \frac{\Delta V_{ab}}{R_{acb}} = \frac{5.37\ \text{V}}{25.5\ \Omega} = 0.211\ \text{A}.$$

If we expand the equivalent resistance R_{abc} back into the original 5.50 Ω and 20.0 Ω resistors,



we see that the current $I_{20.0}$ flows through both of these resistors on the right-most branch. The current through the 20.0 Ω resistor is therefore 0.211 A.

Need Help? Read It

6. 2/2 points Previous Answers **SERCP11 18.3.P.005.**

My Notes Ask Your Teacher

Two resistors, R_1 and R_2, are connected in series.

HINT

(a) If R_1 = 3.22 Ω and R_2 = 8.17 Ω, calculate the single resistance equivalent (in Ω) to the series combination.

11.39 ✔ 11.4 Ω

(b) Repeat the calculation for a parallel combination of R_1 and R_2. (Enter your answer in Ω.)

2.33 ✔ 2.31 The most common mistake in calculating the equivalent resistance for resistors in parallel is to forget to invert the answer after summing the reciprocals. Don't forget to flip it! Ω

Solution or Explanation

(a) Two resistors connected in series have the equivalent resistance $R_{eq} = R_1 + R_2$. Substitute values to find R_{eq} = (3.22 Ω) + (8.17 Ω) = 11.4 Ω.

(b) Two resistors connected in parallel have the equivalent resistance given by $\frac{1}{R_{eq}} = \frac{1}{R_1} + \frac{1}{R_2}$. Substitute values to find

$$\frac{1}{R_{eq}} = \frac{1}{(3.22\ \Omega)} + \frac{1}{(8.17\ \Omega)}.$$

Sum the reciprocals and invert to find R_{eq} = 2.31 Ω.

Need Help? Read It Watch It

7. 4/4 points Previous Answers **SERCP11 18.3.P.006.**

My Notes Ask Your Teacher

Three 2.6 Ω resistors are connected in series with a 15.0 V battery. Find the following.

(a) the equivalent resistance of the circuit

7.80 ✓ 7.8 Ω

(b) the current in each resistor

1.92 ✓ 1.92 A

(c) Repeat for the case in which all three resistors are connected in parallel across the battery.

equivalent resistance .87 ✓ 0.867 Ω

current in each resistor 5.77 ✓ 5.77 A

Solution or Explanation

(a) When the three resistors are in series, the equivalent resistance of the circuit is

$$R_{eq} = R_1 + R_2 + R_3 = 3(2.6\ \Omega) = 7.80\ \Omega.$$

(b) The terminal potential difference of the battery is applied across the series combination of the three 2.6 Ω resistors, so the current supplied by the battery and the current through each resistor in the series combination is

$$I = \frac{\Delta V}{R_{eq}} = \frac{15.0\ \text{V}}{7.80\ \Omega} = 1.92\ \text{A}.$$

(c) If the three 2.6-Ω resistors are now connected in parallel with each other, the equivalent resistance is

$$\frac{1}{R_{eq}} = \frac{1}{2.6\ \Omega} + \frac{1}{2.6\ \Omega} + \frac{1}{2.6\ \Omega} = \frac{3}{2.6\ \Omega}$$

or $R_{eq} = \dfrac{2.6\ \Omega}{3} = 0.867\ \Omega.$

When this parallel combination is connected to the battery, the potential difference across each resistor in the combination is $\Delta V = 15.0$ V, so the current through each of the resistors is

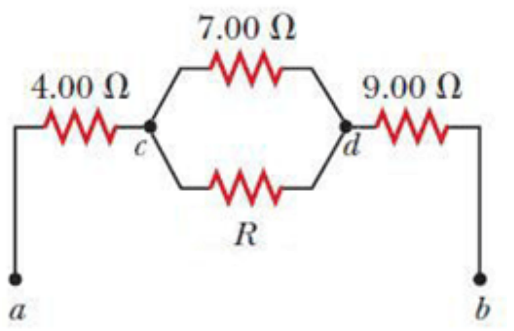
$$I = \frac{\Delta V}{R} = \frac{15.0\ \text{V}}{2.6\ \Omega} = 5.77\ \text{A}.$$

Need Help? Read It

8. 2/5 points Previous Answers **SERCP11 18.3.P.007.MI.**

My Notes Ask Your Teacher

Consider the following figure.



(a) Find the equivalent resistance between points *a* and *b* in the figure. (R = 16.0 Ω)

18 ✔ 17.9 Ω

(b) Calculate the current in each resistor if a potential difference of 10.0 V is applied between points *a* and *b*.

$I_{(4.00\ \Omega)}$ = .56 ✔ 0.56 A

$I_{(7.00\ \Omega)}$ = 2.57 ✘ 0.389 From the value of the current from *a* to *b* find the potential difference across the 7.00-Ω resistor and then find the current through the 7.00-Ω resistor. A

$I_{(16.0\ \Omega)}$ = *(No Response)* 0.17 A

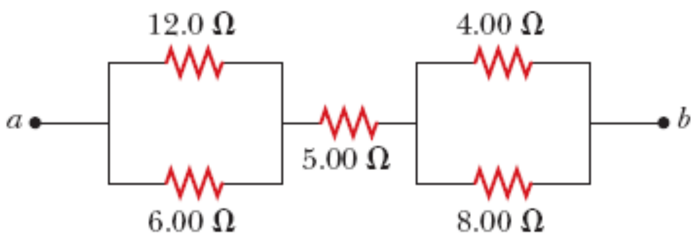
$I_{(9.00\ \Omega)}$ = *(No Response)* 0.56 A

Need Help? Read It Master It

9. 6/6 points Previous Answers **SERCP11 18.3.P.008.**

My Notes Ask Your Teacher

Consider the combination of resistors shown in the figure below.



(a) Find the equivalent resistance between point *a* and *b*.

11.67 ✓ 11.7 Ω

(b) If a voltage of 51.8 V is applied between points *a* and *b*, find the current in each resistor.

12 Ω	1.48 ✓	1.48	A
6 Ω	2.96 ✓	2.96	A
5 Ω	4.44 ✓	4.44	A
4 Ω	2.96 ✓	2.96	A
8 Ω	1.48 ✓	1.48	A

Solution or Explanation

(a) The parallel combination of the 6.00-Ω and 12.0-Ω resistors has an equivalent resistance of

$$\frac{1}{R_{p1}} = \frac{1}{6.00\ \Omega} + \frac{1}{12.0\ \Omega} = \frac{2+1}{12.0\ \Omega} \text{ or } R_{p1} = \frac{12.0\ \Omega}{3} = 4.00\ \Omega.$$

Similarly, the equivalent resistance of the 4.00-Ω and 8.00-Ω parallel combination is

$$\frac{1}{R_{p2}} = \frac{1}{4.00\ \Omega} + \frac{1}{8.00\ \Omega} = \frac{2+1}{8.00\ \Omega} \text{ or } R_{p2} = \frac{8.00\ \Omega}{3}.$$

The total resistance of the series combination between points *a* and *b* is then

$$R_{ab} = R_{p1} + 5.00\ \Omega + R_{p2} = 4.00\ \Omega + 5.00\ \Omega + \frac{8.00}{3}\ \Omega = \frac{35.0\ \Omega}{3}.$$

(b) If ΔV_{ab} = 51.8 V, the total current from *a* to *b* is

$$I_{ab} = \frac{\Delta V_{ab}}{R_{ab}} = \frac{51.8\ \text{V}}{35.0\ \Omega/3} = 4.44\ \text{A}$$

and the potential differences across the two parallel combinations are

$$\Delta V_{p1} = I_{ab}R_{p1} = (4.44\ \text{A})(4.00\ \Omega) = 17.8\ \text{V, and}$$

$$\Delta V_{p1} = I_{ab}R_{p2} = (4.44\ \text{A})\left(\frac{8.00}{3}\ \Omega\right) = 11.8\ \text{V}.$$

The individual currents through the various resistors are:

$$I_{12} = \frac{\Delta V_{p1}}{12.0\ \Omega} = 1.48\ \text{A}$$
$$I_6 = \frac{\Delta V_{p1}}{6.00\ \Omega} = 2.96\ \text{A}$$
$$I_5 = I_{ab} = 4.44\ \text{A}$$
$$I_4 = \frac{\Delta V_{p2}}{4.00\ \Omega} = 2.96\ \text{A}$$
$$I_8 = \frac{\Delta V_{p2}}{8.00\ \Omega} = 1.48\ \text{A}.$$

Need Help? Read It

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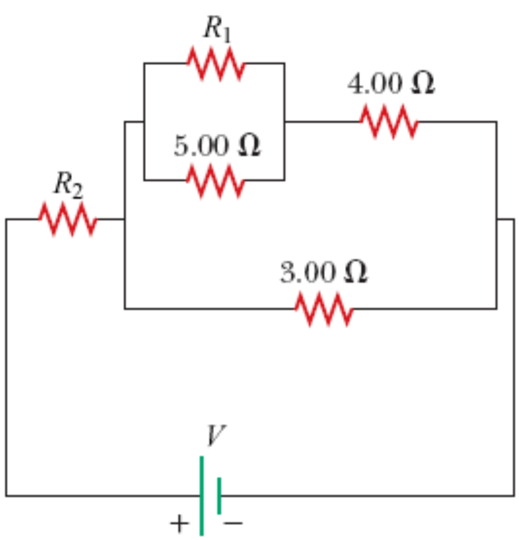
10. 8/8 points Previous Answers **SERCP11 18.3.P.010.**

My Notes Ask Your Teacher

Consider the circuit shown in the figure below. (Assume R_1 = 11.5 Ω, R_2 = 2.70 Ω, and V = 7.60 V.)



(a) Calculate the equivalent resistance of the R_1 and 5.00-Ω resistors connected in parallel.

3.48 ✓ 3.48 Ω

(b) Using the result of part (a), calculate the combined resistance of the R_1, 5.00-Ω and 4.00-Ω resistors.

7.48 ✓ 7.48 Ω

(c) Calculate the equivalent resistance of the combined resistance found in part (b) and the parallel 3.00-Ω resistor.

2.14 ✔ 2.14 Ω

(d) Combine the equivalent resistance found in part (c) with the R_2 resistor.

4.84 ✔ 4.84 Ω

(e) Calculate the total current in the circuit.

1.57 ✔ 1.57 A

(f) What is the voltage drop across the R_2 resistor?

4.24 ✔ 4.24 V

(g) Subtracting the result of part (f) from the battery voltage, find the voltage across the 3.00-Ω resistor.

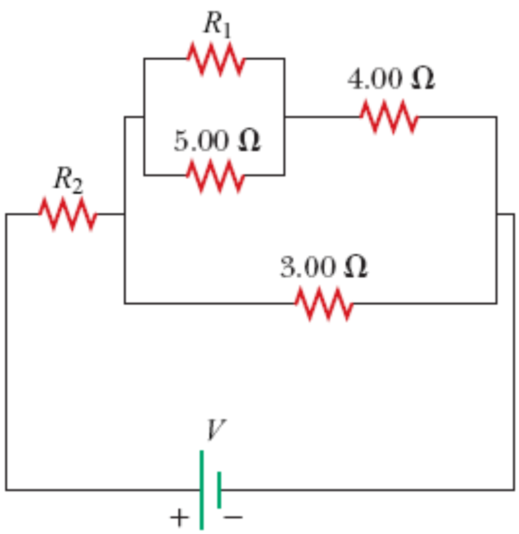
3.36 ✔ 3.36 V

(h) Calculate the current in the 3.00-Ω resistor.

1.12 ✔ 1.12 A

Solution or Explanation

Note: We are displaying rounded intermediate values for practical purposes. However, the calculations are made using the unrounded values.



(a) The equivalent resistance of this first parallel combination is

$$\frac{1}{R_{p1}} = \frac{1}{11.5\ \Omega} + \frac{1}{5.00\ \Omega} \text{ or } R_{p1} = 3.48\ \Omega.$$

(b) For this series combination,

$$R_{\text{upper}} = R_{p1} + 4.00\ \Omega = 7.48\ \Omega.$$

(c) For the second parallel combination,

$$\frac{1}{R_{p2}} = \frac{1}{R_{\text{upper}}} + \frac{1}{3.00\ \Omega} = \frac{1}{7.48\ \Omega} + \frac{1}{3.00\ \Omega} \text{ or } R_{p2} = 2.14\ \Omega.$$

(d) For the second series combination (and hence the entire resistor network)

$$R_{\text{total}} = 2.70\ \Omega + R_{p2} = 2.70\ \Omega + 2.14\ \Omega = 4.84\ \Omega.$$

(e) The total current supplied by the battery is

$$I_{\text{total}} = \frac{\Delta V}{R_{\text{total}}} = \frac{7.60\text{ V}}{4.84\ \Omega} = 1.57\text{ A}.$$

(f) The potential drop across the 2.70 Ω resistor is

$$\Delta V_2 = R_2 I_{\text{total}} = (2.70\ \Omega)(1.57\text{ A}) = 4.24\text{ V}.$$

(g) The potential drop across the second parallel combination must be

$$\Delta V_{p2} = \Delta V - \Delta V_2 = 7.60\text{ V} - 4.24\text{ V} = 3.36\text{ V}.$$

(h) So the current through the 3.00 Ω resistor is

$$I_{\text{total}} = \frac{\Delta V_{p2}}{R_3} = \frac{3.36\text{ V}}{3.00\ \Omega} = 1.12\text{ A}$$

Need Help? Read It

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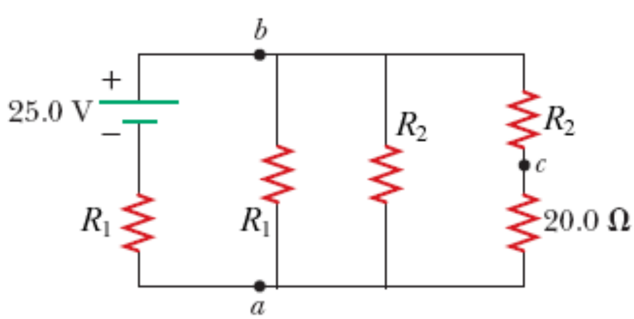
11. 0/2 points Previous Answers **SERCP11 18.3.P.011.**

My Notes Ask Your Teacher

Consider the circuit shown in the figure below. (Assume R_1 = 16.0 Ω and R_2 = 4.00 Ω.)



(a) Find the potential difference between points *a* and *b*.

2.82 ✗ 3.75

Your response differs from the correct answer by more than 10%. Double check your calculations. V

(b) Find the current in the 20.0-Ω resistor.

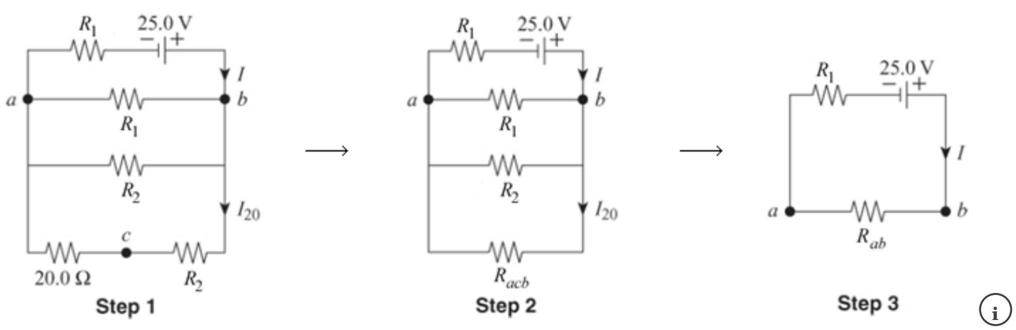
(No Response) 0.156 A

Solution or Explanation

Note: We are displaying rounded intermediate values for practical purposes. However, the calculations are made using the unrounded values.

(a) Using the rules for combining resistors in series and parallel, the circuit reduces as shown below:

Figure | Step 1 | Step 2 | Step 3



Going from Step 1 to Step 2, the resistors in the bottom branch are in series and their effective resistance is calculated as:

$$R_{acb} = 20.0\ \Omega + 4.00\ \Omega = 24.0\ \Omega.$$

The effective resistance of the triple parallel circuit in Step 2 is then determined:

$$\frac{1}{R_{ab}} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_{acb}} = \frac{1}{16.0\ \Omega} + \frac{1}{4.00\ \Omega} + \frac{1}{24.0\ \Omega} = \frac{(96.0 + 384.0 + 64.0)\ \Omega^2}{1536\ \Omega^3}; R_{ab} = 2.82\ \Omega.$$

From the figure of Step 3, observe that

$$I = \frac{25.0\ \text{V}}{16.0\ \Omega + 2.82\ \Omega} = 1.33\ \text{A and } \Delta V_{ab} = I\,R_{ab} = (1.33\ \text{A})(2.82\ \Omega) = 3.75\ \text{V}.$$

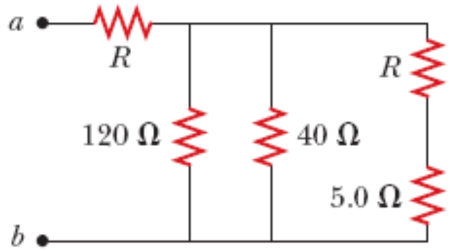
(b) From the figure of Step 1, observe that $I_{20} = \dfrac{\Delta V_{ab}}{24.0\ \Omega} = \dfrac{3.75\ \text{V}}{24.0\ \Omega} = 0.156\ \text{A}.$

Need Help? Read It

12. –/1 points **SERCP11 18.3.P.013.MI.** My Notes Ask Your Teacher

The resistance between terminals *a* and *b* in the figure below is 55 Ω. If the resistors labeled *R* have the same value, determine *R*.

R = (No Response) 37.4 Ω



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