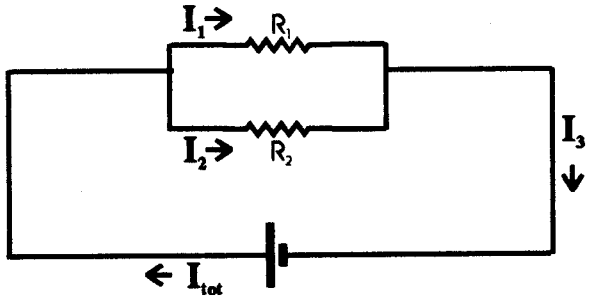
Chapter 8 Parallel Circuits

In-Class Questions

Prerequisite Concepts:

- **Kirchoff's Junction Rule: current into junction equals current out**

Questions #1–6 refer to this diagram:



1. As shown in the diagram, I_{tot} refers to the current flowing out of the battery. How does the magnitude of I_3 compare to that of I_{tot}?

   A. $I_3 > I_{tot}$
   B. $I_3 = I_{tot}$
   C. $I_3 < I_{tot}$
   D. answer depends on the magnitudes of R_1 and R_1
   E. answer depends on the magnitude of the battery voltage

2. How does the magnitude of I_1 compare to that of I_{tot}?

   A. $I_1 > I_{tot}$
   B. $I_1 = I_{tot}$
   C. $I_1 < I_{tot}$
   D. answer depends on the magnitudes of R_1 and R_1
   E. answer depends on the magnitude of the battery voltage

3. Let ΔV_{R_1} represent the *magnitude* of the potential difference between the two sides of resistor R_1. How does ΔV_{R_1} compare to the magnitude of the battery voltage, ΔV_{bat}?

   A. $\Delta V_{R_1} > \Delta V_{bat}$
   B. $\Delta V_{R_1} = \Delta V_{bat}$
   C. $\Delta V_{R_1} < \Delta V_{bat}$
   D. answer depends on magnitude of R_1
   E. answer depends on relative magnitudes of R_1 and R_2

4. Let ΔV_{R_2} represent the *magnitude* of the potential difference between the two sides of resistor R_2. How does ΔV_{R_2} compare to the magnitude of the battery voltage, ΔV_{bat}?

   A. $\Delta V_{R_2} > \Delta V_{bat}$
   B. $\Delta V_{R_2} = \Delta V_{bat}$
   C. $\Delta V_{R_2} < \Delta V_{bat}$
   D. answer depends on magnitude of R_1
   E. answer depends on relative magnitudes of R_1 and R_2

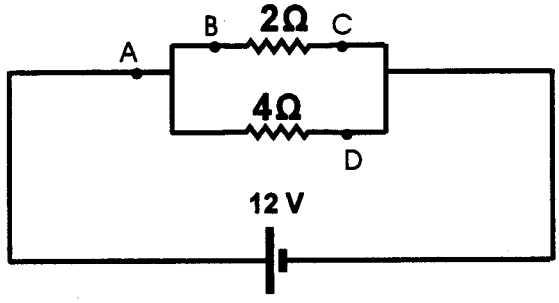
5. If $R_1 = R_2$, how do the currents through the resistors compare?

   A. $I_1 > I_2$
   B. $I_1 = I_2$
   C. $I_1 < I_2$
   D. answer depends on the magnitude of the battery voltage

6. If $R_1 > R_2$, how do the currents through the resistors compare?

   A. $I_1 > I_2$
   B. $I_1 = I_2$
   C. $I_1 < I_2$
   D. answer depends on the magnitude of the battery voltage

Questions #7–15 refer to the diagram below. Assume that the magnitude of the electric potential at the ***negative*** *terminal of the battery is 0 volts.*



7. What is the magnitude of the electric potential at point A?

   A. 0 V
   B. 3 V
   C. 4 V
   D. 6 V
   E. 8 V
   F. 12 V

8. What is the magnitude of the electric potential at point B?

   A. 0 V
   B. 3 V
   C. 4 V
   D. 6 V
   E. 8 V
   F. 12 V

9. What is the magnitude of the electric potential at point C?

   A. 0 V
   B. 3 V
   C. 4 V
   D. 6 V
   E. 8 V
   F. 12 V

10. What is the magnitude of the electric potential at point D?

   A. 0 V
   B. 3 V
   C. 4 V
   D. 6 V
   E. 8 V
   F. 12 V

11. What is the value of $I_{4\Omega}$, i.e., the magnitude of current flow through the 4Ω resistor?

   A. 3 A
   B. 4 A
   C. 6 A
   D. 8 A
   E. 9 A
   F. 12 A

12. What is the value of $I_{2\Omega}$, i.e., the magnitude of current flow through the 2Ω resistor?

A. 3 A
B. 4 A
C. 6 A
D. 8 A
E. 9 A
F. 12 A

13. What is the magnitude of current flowing past point B?

A. 3 A
B. 4 A
C. 6 A
D. 8 A
E. 9 A
F. 12 A

14. What is the magnitude of current flowing past point D?

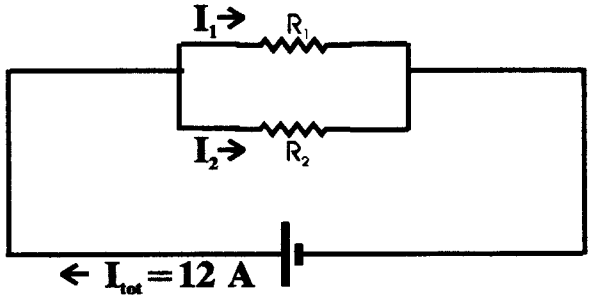
A. 3 A
B. 4 A
C. 6 A
D. 8 A
E. 9 A
F. 12 A

15. What is the magnitude of I_{tot}?

A. 3 A
B. 4 A
C. 6 A
D. 8 A
E. 9 A
F. 12 A

In-Class Exercises

Questions #1–4 refer to this figure:



Let I_1 and I_2 represent the current flowing through resistors R_1 and R_2, respectively. I_{tot} = 12 A, as indicated.

1. What is the value of $(I_1 + I_2)$?

   $(I_1 + I_2)$ = _____

2. If $R_2 = R_1$, find the following values:

   $\frac{I_1}{I_2}$ = _____

   I_1 = _____

   I_2 = _____

3. If $R_2 = 2R_1$, find the following values:

   $\frac{I_1}{I_2}$ = _____

   I_1 = _____

   I_2 = _____

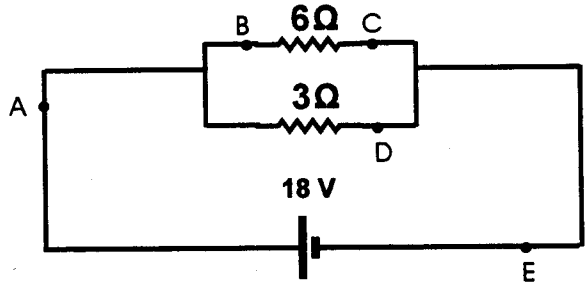
4. If $R_2 = 3R_1$, find the following values:

   $\frac{I_1}{I_2}$ = _____

   I_1 = _____

   I_2 = _____

Questions #5–7 refer to this diagram:



5. Assume that the potential at the negative terminal of the battery is 0 volts. Indicate the potential at the following points:

   A: _____

   B: _____

   C: _____

   D: _____

   E: _____

6. Write down the magnitude of the following potential differences:

   A. ΔV_{AC} = _____

   B. ΔV_{BE} = _____

   C. ΔV_{CE} = _____

   D. ΔV_{DA} = _____

   E. ΔV_{BD} = _____

7. Write down the amount of current flowing past the following points in the circuit:

   A: _____

   B: _____

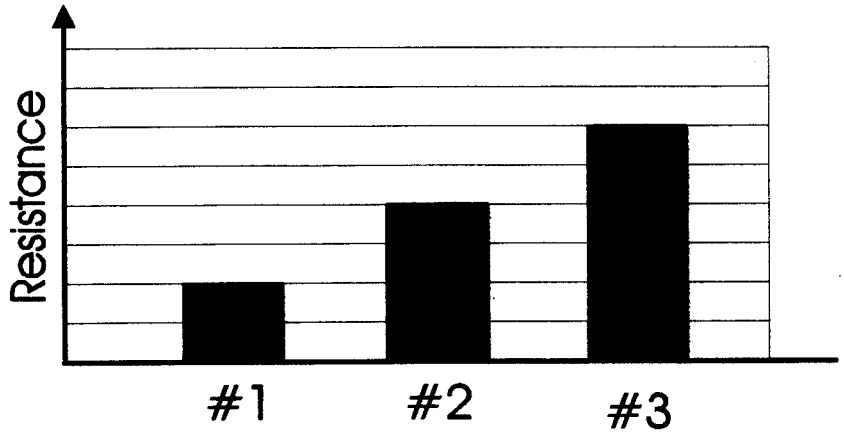
   C: _____

   D: _____

   E: _____

Homework Exercises

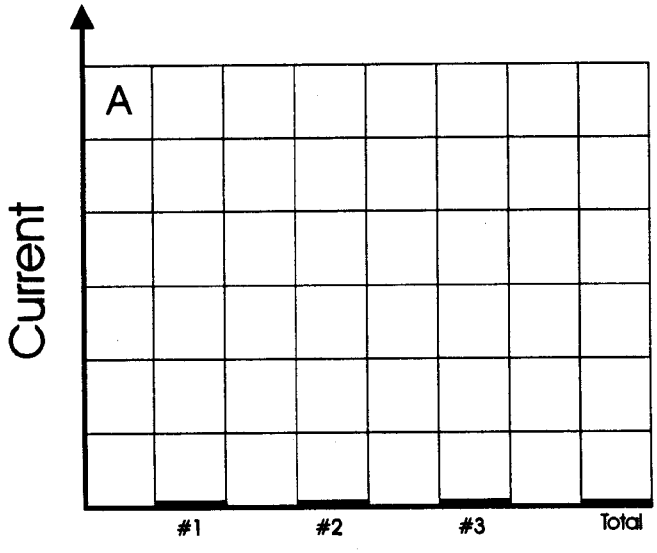
1. Three resistors are connected in parallel to a battery. The bar graph below shows the relative magnitudes of the three resistances.

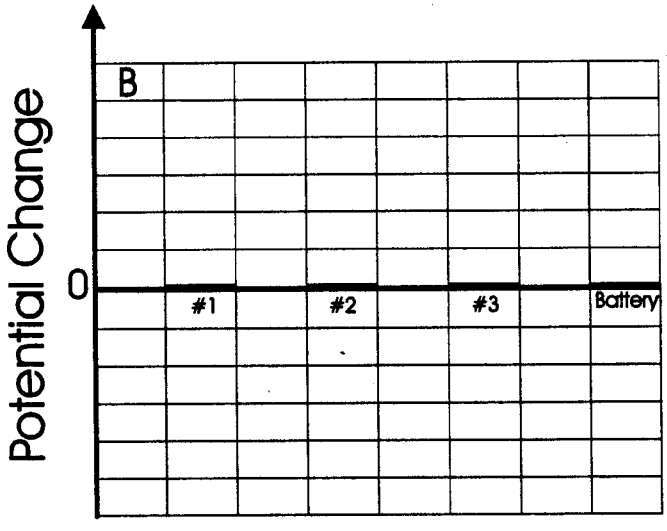


On the bar graphs below, draw:

A. three bars, representing the relative magnitudes of the current passing through each resistor, and a fourth bar indicating the relative magnitude of the current flowing through the battery (this is the "total current in the circuit").

B. three bars, representing the relative sizes of the potential changes experienced by the current as it flows across each resistor, and a fourth bar indicating the relative size of the potential change experienced by the current as it flows between the terminals of the battery. Indicate increasing potential as a *positive* change, and decreasing potential as a *negative* change.





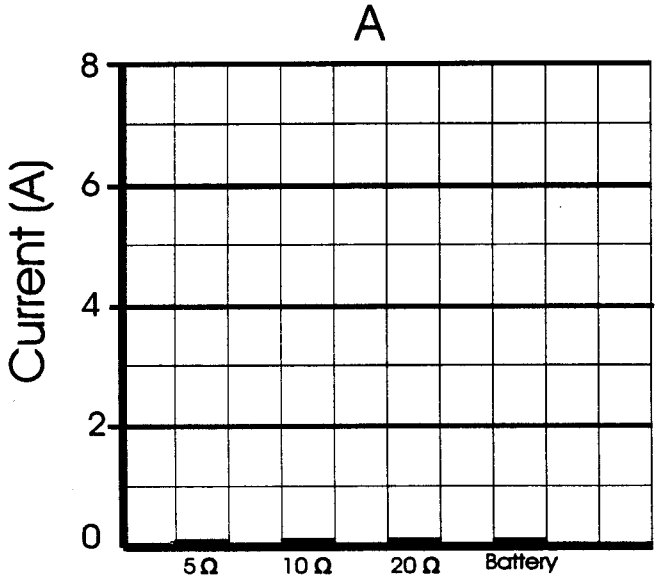
2. A 5-ohm resistor, a 10-ohm resistor and a 20-ohm resistor are connected in parallel with a 20-V battery. (Each of the following bar graphs should have four bars.)

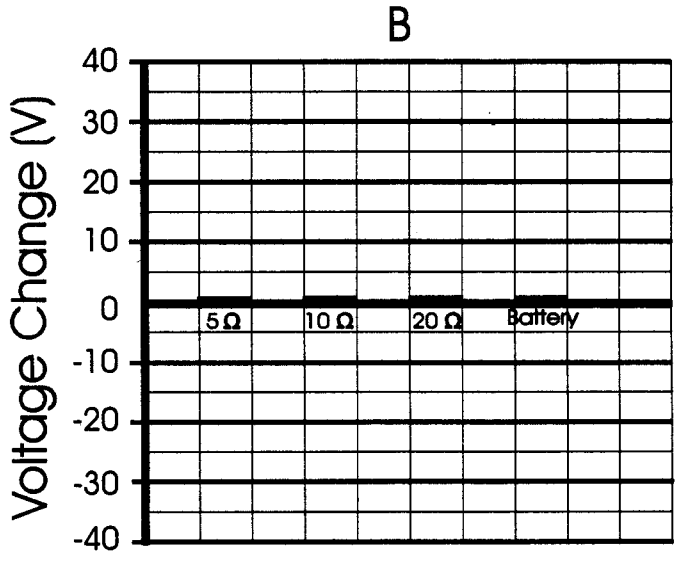
   A. Draw a bar graph showing the current flowing through the 5-ohm resistor, the 10-ohm resistor, the 20-ohm resistor, and the battery.

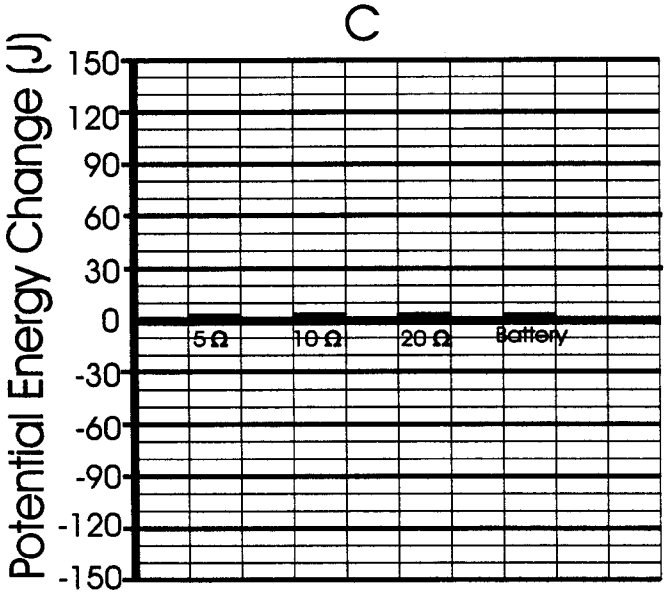
   B. Draw a bar graph showing the potential changes experienced by the current as it flows around the circuit. Indicate the potential increase (positive) or decrease (negative) across the 5-ohm resistor, the 10-ohm resistor, and the 20-ohm resistor, and between the terminals of the battery.

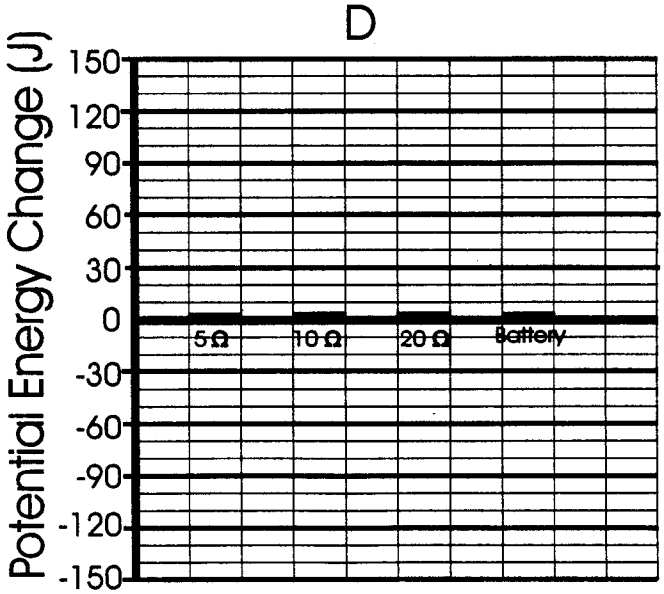
   C. Draw a bar graph showing the amount of potential energy gained (positive change) or lost (negative change) by a 2-C charge as it goes through the 5-ohm resistor, the 10-ohm resistor, the 20-ohm resistor, and the battery.

   D. Repeat C, this time assuming the battery is 40 V.









3. A 2-Ω and a 4-Ω resistor are connected in parallel to a battery. $\Delta V_4 = 12$ V. $\Delta V_{bat} = ?$ Explain your answer.

4. A 3-Ω and a 5-Ω resistor are connected in parallel to a battery. $I_{3\Omega} = 6$ A. $\Delta V_{bat} = ?$ Explain your answer.