23 Series and Parallel Circuits

1. Three 25.0-Ω resistors are connected in series across a 60.0-V battery.

a. What is the equivalent resistance of the circuit?

b. What is the current in the circuit?

c. What is the voltage drop across each resistor?

2. A string of 36 identical holiday lights is connected in series to a 120-V source. The current through the bulbs is 0.40 A.

a. What is the equivalent resistance of the light string?

b. What is the resistance of each bulb?

c. What power is dissipated by the light string?

3. A lamp with a resistance of 8 Ω is connected across a 24-V battery.

a. What is the current through the lamp?

b. What resistance must be connected in series with the lamp to reduce the current to 1.6 A?

4. A 12-Ω resistor and a 28-Ω resistor are connected in series across a battery. The current in the circuit is 0.90 A.

a. What is the voltage of the battery?

b. What is the voltage drop across the 12-W resistor?

5. Three resistors are connected in series across a 75-V potential difference. R_1 is 170 Ω and R_2 is 190 Ω. The potential difference across R_3 is 21 V.

a. Find the current in the circuit.

b. Find the resistance of R_3.

6. A 15-V battery and two resistors, R_B of 36 Ω and R_A of 84 Ω, are connected as a voltage divider. What is the voltage across the 36-W resistor?

7. Maria is designing a voltage divider using a 30.0-V battery and a 375-Ω resistor as R_B. What resistor should be used as R_A if the output voltage across R_B is to be 22.5 V?

8. A 25-Ω resistor, a 55-Ω resistor, and a 75-Ω resistor are connected in parallel and placed across a 9.0-V battery.

a. What is the equivalent resistance of the parallel circuit?

b. What is the current through the entire circuit?

c. What is the current through each branch of the circuit?

9. Suppose that the 25-Ω resistor in problem 8 is replaced by a 45-Ω resistor. Without performing any calculations, describe qualitatively the change in each of the following.

a. the equivalent resistance of the parallel circuit

b. the current through the entire circuit

c. the current through each branch of the circuit

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10. Two resistors, one 130 Ω and the other 210 Ω, are connected in parallel. The resistors are then connected to a battery. If the current through the entire circuit is 0.31 A, what is the voltage of the battery?

11. Resistors R_1, R_2, and R_3 are connected in parallel. R_1 is 68 Ω and R_2 is 93 Ω. The equivalent resistance of the parallel combination is 26 Ω. What is the resistance of R_3?

12. Four identical resistors are connected in parallel. The equivalent resistance of the parallel combination is 4.5 Ω. What is the resistance of each resistor?

13. A 120-V household circuit that contains a 320-W television, a 1.0×10^2-W lamp, and a 1350-W heater is connected to a 2.0×10^1-A fuse. Will the fuse melt if all three devices are operating simultaneously? Explain.

14. Resistors R_1, R_2, and R_3 have resistances of 37.0 Ω, 22.0 Ω, and 41.0 Ω respectively. R_1 and R_2 are connected in series, and their combination is in parallel with R_3. This arrangement is then placed across a 60.0-V battery.

a. Draw the circuit diagram.

b. What is the equivalent resistance of the three resistors?

c. What is the current in the circuit?

d. What is the current through R_3?

e.. What is the potential difference across R_1?

15. A 19-Ω resistor is connected in series to a 45-V battery and two 12-Ω resistors that are connected in parallel to each other.

a. Draw the circuit diagram.

b. What is the equivalent resistance of the three resistors?

c. What is the current in the circuit?

d. What is the current through one of the 12-Ω resistors?

e. What is the potential difference across the 19-Ω resistor?