20. (III) What is the net resistance of the circuit connected to the battery in Fig. 19–41? Each resistance has $R = 2.8\,\text{k}\Omega$.

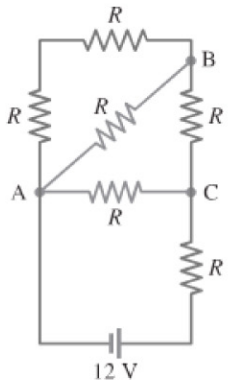

FIGURE 19–41 Problem 20.

21. (III) Three equal resistors (R) are connected to a battery as shown in Fig. 19–42. Qualitatively, what happens to (*a*) the voltage drop across each of these resistors, (*b*) the current flow through each, and (*c*) the terminal voltage of the battery, when the switch S is opened, after having been closed for a long time? (*d*) If the emf of the battery is 15.0 V, what is its terminal voltage when the switch is closed if the internal resistance is $0.50\,\Omega$ and $R = 5.50\,\Omega$? (*e*) What is the terminal voltage when the switch is open?

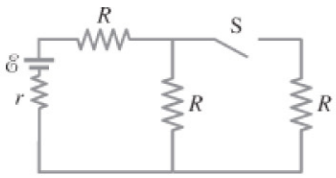

FIGURE 19–42 Problem 21.

22. (III) A 2.8-kΩ and a 2.1-kΩ resistor are connected in parallel; this combination is connected in series with a 1.8-kΩ resistor. If each resistor is rated at $\frac{1}{2}$ W (maximum without overheating), what is the maximum voltage that can be applied across the whole network?

19–3 Kirchhoff's Rules

23. (I) Calculate the current in the circuit of Fig. 19–43 and show that the sum of all the voltage changes around the circuit is zero.

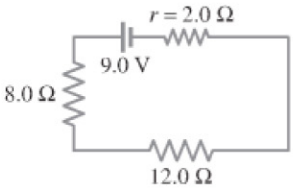

FIGURE 19–43 Problem 23.

24. (II) Determine the terminal voltage of each battery in Fig. 19–44.

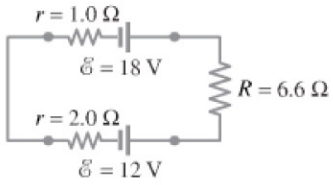

FIGURE 19–44 Problem 24.

25. (II) (*a*) What is the potential difference between points a and d in Fig. 19–45 (same circuit as Fig. 19–13, Example 19–8), and (*b*) what is the terminal voltage of each battery?

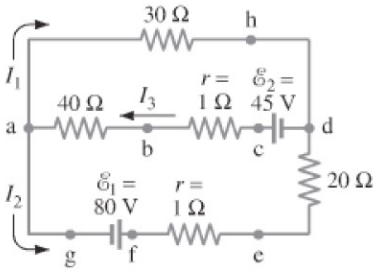

FIGURE 19–45 Problem 25.

26. (II) For the circuit shown in Fig. 19–46, find the potential difference between points a and b. Each resistor has $R = 75\,\Omega$ and each battery is 1.5 V.

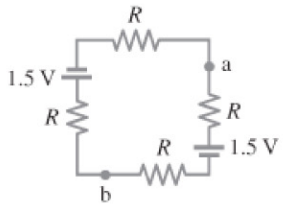

FIGURE 19–46 Problem 26.

27. (II) Determine the magnitudes and directions of the currents through R_1 and R_2 in Fig. 19–47.

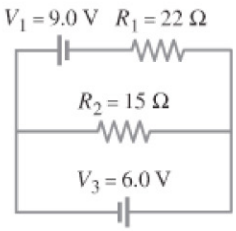

FIGURE 19–47 Problems 27 and 28.

28. (II) Repeat Problem 27, now assuming that each battery has an internal resistance $r = 1.2\,\Omega$.