29. (II) Determine the magnitudes and directions of the currents in each resistor shown in Fig. 19–48. The batteries have emfs of $\mathscr{E}_1 = 9.0\text{ V}$ and $\mathscr{E}_2 = 12.0\text{ V}$ and the resistors have values of $R_1 = 25\ \Omega$, $R_2 = 18\ \Omega$, and $R_3 = 35\ \Omega$.

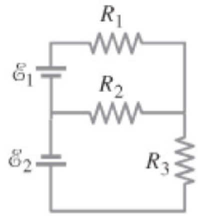

FIGURE 19–48 Problems 29 and 30.

30. (II) Repeat Problem 29, assuming each battery has internal resistance $r = 1.0\ \Omega$.

31. (II) Calculate the currents in each resistor of Fig. 19–49.

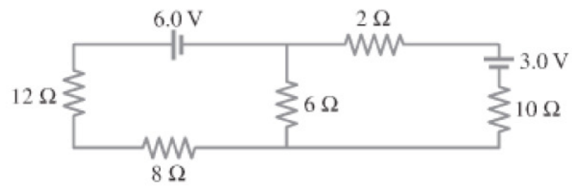

FIGURE 19–49 Problem 31.

32. (III) (*a*) Determine the currents I_1, I_2, and I_3 in Fig. 19–50. Assume the internal resistance of each battery is $r = 1.0\ \Omega$. (*b*) What is the terminal voltage of the 6.0-V battery?

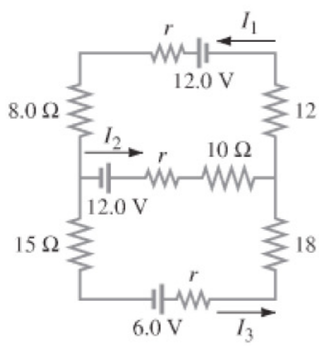

FIGURE 19–50 Problems 32 and 33.

33. (III) What would the current I_1 be in Fig. 19–50 if the 12-Ω resistor is shorted out? Let $r = 1.0\ \Omega$.

* 19–4 Emfs Combined, Battery Charging

* 34. (II) Suppose two batteries, with unequal emfs of 2.00 V and 3.00 V, are connected as shown in Fig. 19–51. If each internal resistance is $r = 0.100\ \Omega$, and $R = 4.00\ \Omega$, what is the voltage across the resistor R?

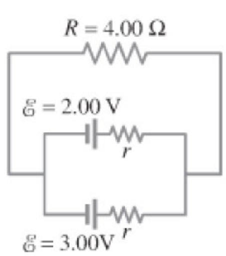

FIGURE 19–51 Problem 34.

19–5 Capacitors in Series and in Parallel

35. (I) (*a*) Six 4.7-μF capacitors are connected in parallel. What is the equivalent capacitance? (*b*) What is their equivalent capacitance if connected in series?

36. (I) You have three capacitors, of capacitance 3200 pF, 7500 pF, and 0.0100 μF. What maximum and minimum capacitance can you form from these? How do you make the connection in each case?

37. (I) A 3.00-μF and a 4.00-μF capacitor are connected in series, and this combination is connected in parallel with a 2.00-μF capacitor (see Fig. 19–52). What is the net capacitance?

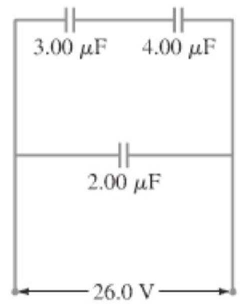

FIGURE 19–52 Problems 37 and 38.

38. (II) If 26.0 V is applied across the whole network of Fig. 19–52, calculate the voltage across each capacitor.

39. (II) The capacitance of a portion of a circuit is to be reduced from 4800 pF to 2900 pF. What capacitance can be added to the circuit to produce this effect without removing existing circuit elements? Must any existing connections be broken in the process?

40. (II) An electric circuit was accidentally constructed using a 5.0-μF capacitor instead of the required 16-μF value. Without removing the 5.0-μF capacitor, what can a technician add to correct this circuit?

41. (II) Determine the equivalent capacitance of the circuit shown in Fig. 19–53.

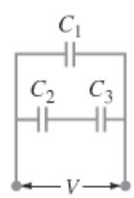

FIGURE 19–53 Problems 41, 42, 43, and 44.

* 42. (II) In Fig. 19–53, if $C_1 = C_2 = 2C_3 = 22.6\ \mu\text{F}$, how much charge is stored on each capacitor when $V = 45.0\text{ V}$?

* 43. (II) In Fig. 19–53, suppose $C_1 = C_2 = C_3 = 16.0\ \mu\text{F}$. If the charge on C_2 is $Q_2 = 24.0\ \mu\text{C}$, determine the charge on each of the other capacitors, the voltage across each capacitor, and the voltage V across the entire combination.

* 44. (II) In Fig. 19–53, let $V = 78\text{ V}$ and $C_1 = C_2 = C_3 = 7.2\ \mu\text{F}$. How much energy is stored in the capacitor network?

* 45. (II) A 0.40-μF and a 0.60-μF capacitor are connected in series to a 9.0-V battery. Calculate (*a*) the potential difference across each capacitor, and (*b*) the charge on each. (*c*) Repeat parts (*a*) and (*b*) assuming the two capacitors are in parallel.