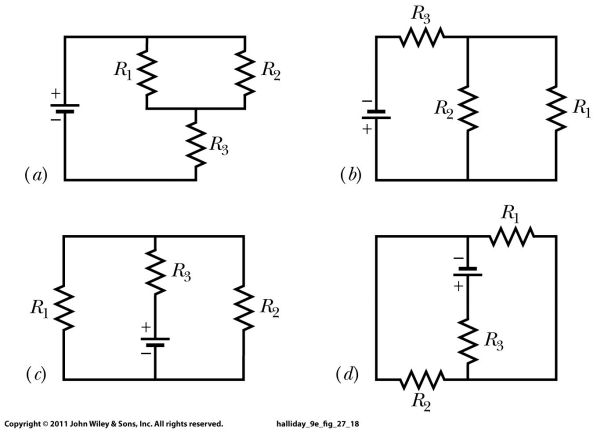
Homework for Chapter 27

(Due 10/27/22)

Questions: 2, 8, 10
Exercises & Problems: 1, 23, 33, 45, 48, 61, 63, 72, 92

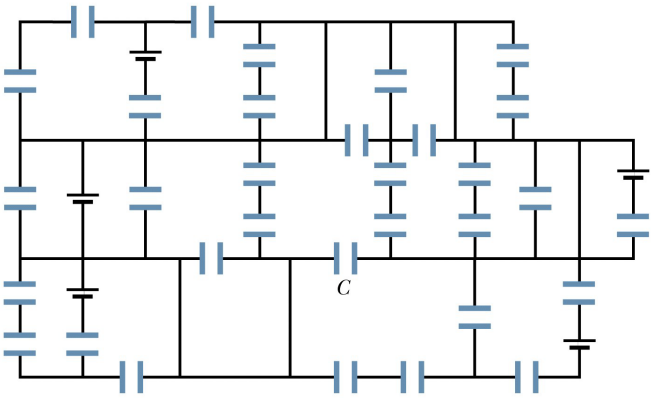
Question 2

(a) In Fig. 27-18*a*, are resistors R_1 and R_3 in series? (b) Are resistors R_1 and R_2 in parallel? (c) Rank the equivalent resistances of the four circuits shown in Fig. 27-18, greatest first.



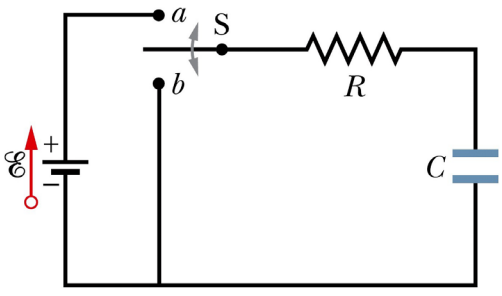
Question 8

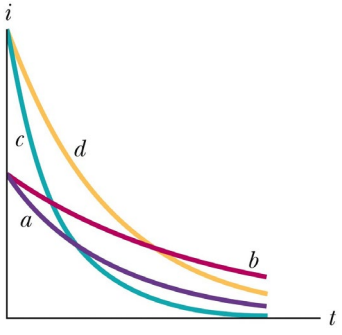
Cap-monster maze. In Fig. 27-22, all the capacitors have a capacitance of 6.0 μF, and all the batteries have an emf of 10 V. What is the charge on capacitor *C*? (If you can find the proper loop through this maze, you can answer the question with a few seconds of mental calculation.)



Question 10

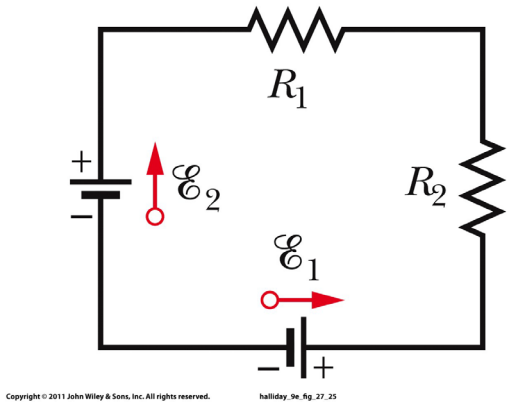
After the switch in Fig. 27-15 is closed on point *a*, there is current *i* through resistance *R*. Figure 27-23 gives that current for four sets of values of *R* and capacitance *C*: (1) R_0 and C_0, (2) $2R_0$ and C_0, (3) R_0 and $2C_0$, (4) $2R_0$ and $2C$. Which set goes with which curve?





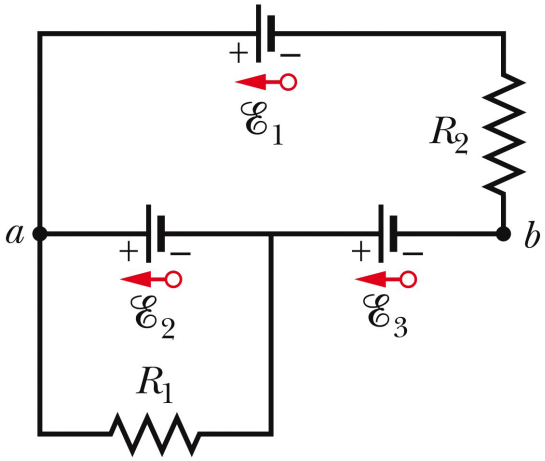
Problem 1

In Fig. 27-25, the ideal batteries have emfs $\mathcal{E}_1 = 12$ V and $\mathcal{E}_2 = 6.0$ V. What are (a) the current, the dissipation rate in (b) resistor 1 (4.0 Ω) and (c) resistor 2 (8.0 Ω), and the energy transfer rate in (d) battery 1 and (e) battery 2? Is energy being supplied or absorbed by (f) battery 1 and (g) battery 2?



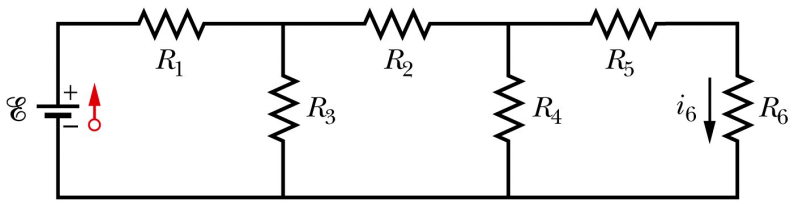
Problem 23

In Fig. 27-35, $R_1 = 100$ Ω, $R_2 = 50$ Ω, and the ideal batteries have emfs $\mathcal{E}_1 = 6.0$ V, $\mathcal{E}_2 = 5.0$ V, and $\mathcal{E}_3 = 4.0$ V. Find (a) the current in resistor 1, (b) the current in resistor 2, and (c) the potential difference between points *a* and *b*.



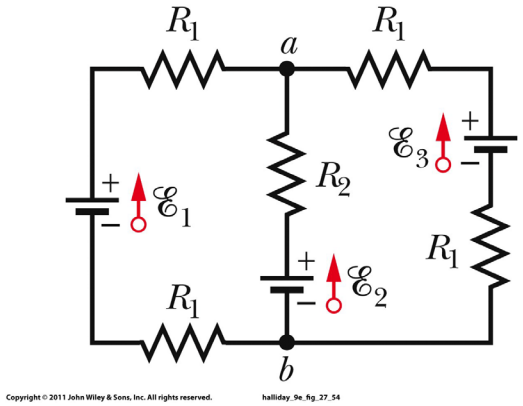
Problem 33

In Fig. 27-44, the current in resistance 6 is $i_6 = 1.40$ A and the resistances are $R_1 = R_2 = R_3 = 2.00$ Ω, $R_4 = 16.0$ Ω, $R = 8.00$ Ω, and $R_6 = 4.00$ Ω. What is the emf of the ideal battery?



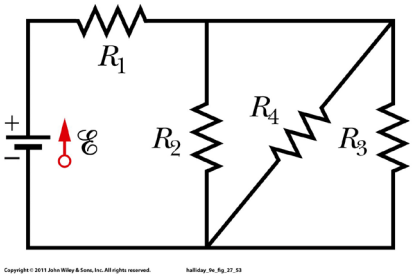
Problem 45

In Fig. 27-54, the resistances are $R_1 = 1.0\ \Omega$ and $R_2 = 2.0\ \Omega$, and the ideal batteries have emfs $\mathcal{E}_1 = 2.0$ V and $\mathcal{E}_2 = \mathcal{E}_3 = 4.0$ V. What are the (a) size and (b) direction (up or down) of the current in battery 1, the (c) size and (d) direction of the current in battery 2, and the (e) size and (f) direction of the current in battery 3? (g) What is the potential difference $V_a - V_b$?



Problem 48

In Fig. 27-53, the resistors have the values $R_1 = 7.00\ \Omega$, $R_2 = 12.0\ \Omega$, and $R_3 = 4.00\ \Omega$, and the ideal battery's emf is $\mathcal{E} = 24.0$ V. For what value of R_4 will the rate at which the battery transfers energy to the resistors equal (a) 60.0 W, (b) the maximum possible rate P_{max}, and (c) the minimum possible rate P_{min}? What are (d) P_{max} and (e) P_{min}?

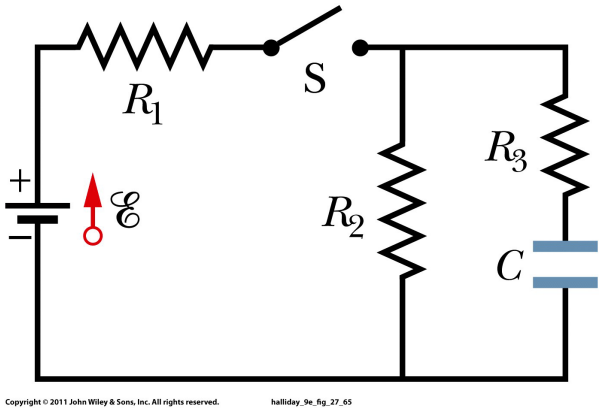


Problem 61

A 15.0 kΩ resistor and a capacitor are connected in series, and then a 12.0 V potential difference is suddenly applied across them. The potential difference across the capacitor rises to 5.00 V in 1.30 μs. (a) Calculate the time constant of the circuit. (b) Find the capacitance of the capacitor.

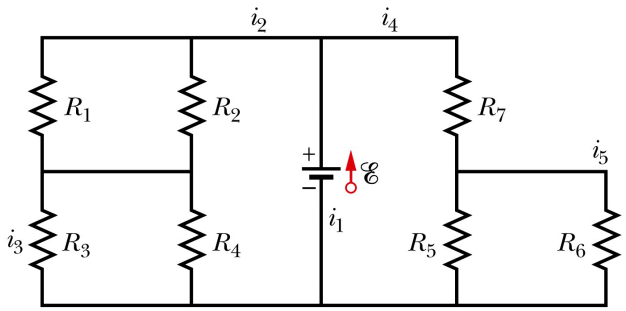
Problem 63

In the circuit of Fig. 27-65, $\mathcal{E} = 1.2$ kV, $C = 6.5\ \mu$F, $R_1 = R_2 = R_3 = 0.73\ M\Omega$. With C completely uncharged, switch S is suddenly closed (at $t = 0$). At $t = 0$, what are (a) current i_1 in resistor 1, (b) current i_2 in resistor 2, and (c) current i_3 in resistor 3? At $t =$ oo (that is, after many time constants), what are (d) i_1, (e) i_2, and (f) i_3? What is the potential difference V_2 across resistor 2 at (g) $t = 0$ and (h) $t =$ oo? (i) Sketch V_2 versus t between these two extreme times.



Problem 72

In Fig. 27-70, the ideal battery has emf $\varepsilon = 30.0$ V, and the resistances are $R_1 = R_2 = 14\ \Omega$, $R_3 = R_4 = R_5 = 6.0\ \Omega$, $R_6 = 2.0\ \Omega$, and $R_7 = 1.5\ \Omega$. What are currents (a) i_2, (b) i_4, (c) i_1, (d) i_3, and (e) i_5?



Problem 92

Figure 27-78 shows a portion of a circuit through which there is a current $I = 6.00$ A. The resistances are $R_1 = R_2 = 2.00R_3 = 2.00R_4 = 4.00\ \Omega$. What is the current i_1 through resistor 1?