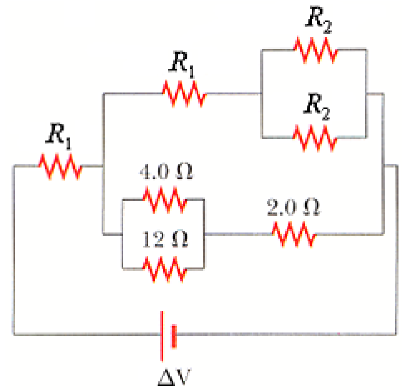
13. Calculate the current in the 12 Ω resistor. (R_1 = 3.0 Ω, R_2 = 6.0 Ω, ΔV = 18 V).



18.13 The resistors in the circuit can be combined in the stages shown below to yield an equivalent resistance of $R_{ad} = (63/11)\ \Omega$.

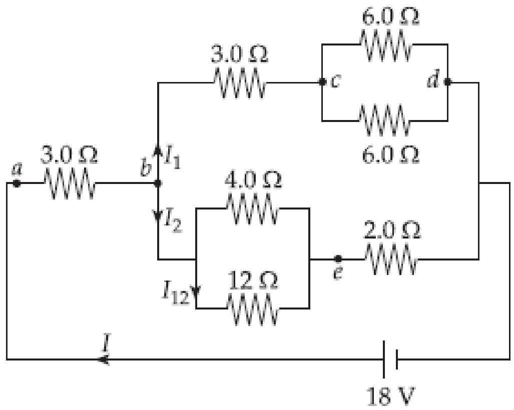


Figure 1

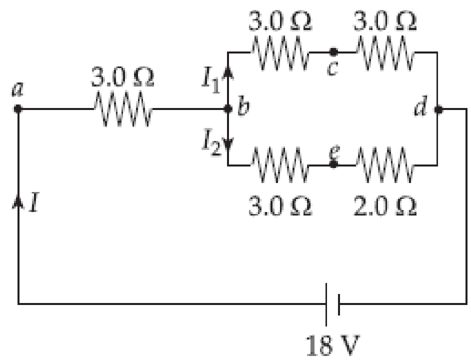


Figure 2

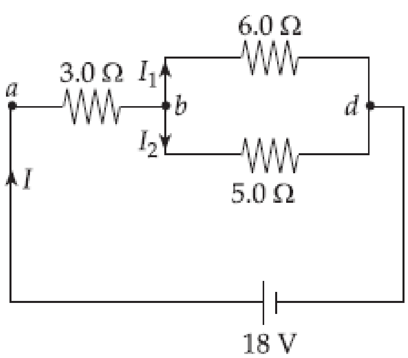


Figure 3

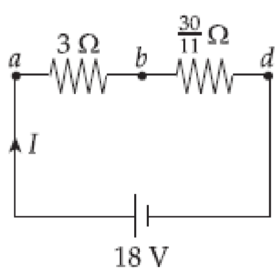


Figure 4

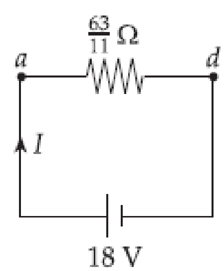


Figure 5

From Figure 5, $I = \dfrac{(\Delta V)_{ad}}{R_{ad}} = \dfrac{18\text{ V}}{(63/11)\ \Omega} = 3.14\text{ A}$

Then, from Figure 4, $(\Delta V)_{bd} = I\,R_{bd} = (3.14\text{ A})(30/11\ \Omega) = 8.57\text{ V}$

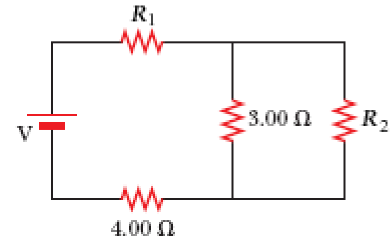
Now, look at Figure 2 and observe that

$$I_2 = \frac{(\Delta V)_{bd}}{3.0\ \Omega + 2.0\ \Omega} = \frac{8.57\text{ V}}{5.0\ \Omega} = 1.71\text{ A}$$

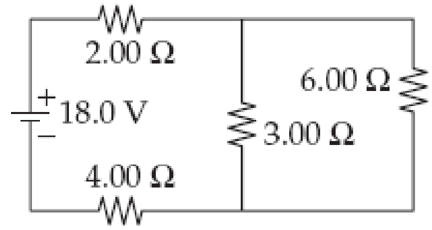
so $(\Delta V)_{be} = I_2 R_{be} = (1.71\text{ A})(3.0\ \Omega) = 5.14\text{ V}$

Finally, from Figure 1, $I_{12} = \dfrac{(\Delta V)_{be}}{R_{12}} = \dfrac{5.14\text{ V}}{12\ \Omega} = \boxed{0.43\text{ A}}$

14. (a) Calculate the current in the 5.00 Ω resistor.
(b) Calculate the power delivered by the battery to the circuit.



18.14 (a) The resistor network connected to the battery in Figure P18.14 can be reduced to a single equivalent resistance in the following steps. The equivalent resistance of the parallel combination of the 3.00 Ω and 6.00 Ω resistors is



$$\frac{1}{R_p} = \frac{1}{3.00\ \Omega} + \frac{1}{6.00\ \Omega} = \frac{3}{6.00\ \Omega} \quad \text{or} \quad R_p = 2.00\ \Omega$$

This resistance is in series with the $4.00\ \Omega$ and the other $2.00\ \Omega$ resistor, giving a total equivalent resistance of $\boxed{R_{eq} = 2.00\ \Omega + R_p + 4.00\ \Omega = 8.00\ \Omega}$.

(b) The current in the 2.00 Ω resistor is the total current supplied by the battery and is equal to

$$I_{total} = \frac{\Delta V}{R_{eq}} = \frac{18.0\ \text{V}}{8.00\ \Omega} = \boxed{2.25\ \text{A}}$$

(c) The power the battery delivers to the circuit is

$$\mathcal{P} = (\Delta V) I_{total} = (18.0\ \text{V})(2.25\ \text{A}) = \boxed{40.5\ \text{W}}$$