31.34. **Model:** Grounding does not affect a circuit’s behavior.  
**Visualize:** Please refer to Figure Ex31.34.  
**Solve:** Because the earth has $V_{\text{earth}} = 0$ V, point d has a potential of zero. In going from point d to point a, the potential increases by 9 V. Thus, point a is at a potential of 9 V. Let us calculate the current $I$ in the circuit before calculating the potentials at points b and c. Applying Kirchhoff’s loop rule, starting clockwise from point d,

$$\sum (\Delta V) = \Delta V_{\text{bat}} + \Delta V_{2\Omega} + \Delta V_{3\Omega} + \Delta V_{4\Omega} = 0$$

$$\Rightarrow +9 \text{ V} - I(2 \Omega) - 3 \text{ V} - I(4 \Omega) = 0 \Rightarrow I = \frac{6 \text{ V}}{6\Omega} = 1 \text{ A}$$

There is a drop in potential from point a to point b by an amount $IR = (1 \text{ A})(2 \Omega) = 2$ V. Thus, the potential at point b is $9 \text{ V} - 2 \text{ V} = 7$ V. The potential decreases from 7 V at point b to $7 \text{ V} - 3 \text{ V} = 4$ V at point c. There is a further decrease in potential across the $4 \Omega$ resistor of $IR = (1 \Omega)(4 \Omega) = 4$ V. That is, the potential of 4 V at c becomes 0 V at point d, as it must. In summary, the potentials at a, b, c, and d are 9 V, 7 V, 4 V, and 0 V.