Section 2-9 Switches

P 2.9-1 Determine the current, i, at $t = 1$ s and at $t = 4$ s for the circuit of Figure P 2.9-1.

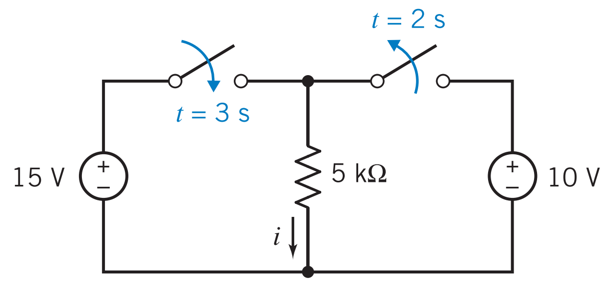
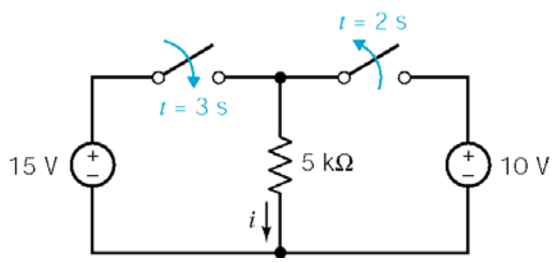


Figure P 2.9-1

Solution:



At $t = 1$ s the left switch is open and the right switch is closed so the voltage across the resistor is 10 V.

$$i = \frac{v}{R} = \frac{10}{5\times10^3} = \underline{2 \text{ mA}}$$

At $t = 4$ s the left switch is closed and the right switch is open so the voltage across the resistor is 15 V.

$$i = \frac{v}{R} = \frac{15}{5\times10^3} = \underline{3 \text{ mA}}$$

P 2.9-2 Determine the voltage, v, at $t = 1$ s and at $t = 4$ s for the circuit shown in Figure P 2.9-2.

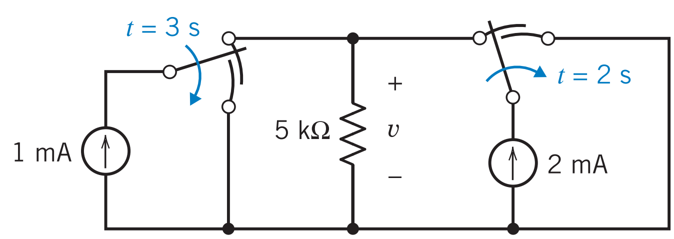
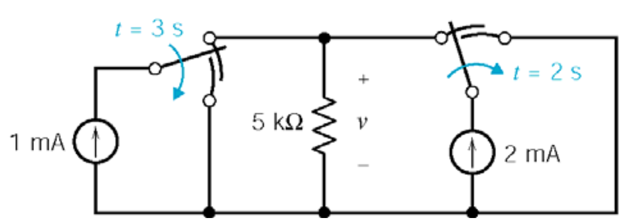


Figure P 2.9-2

Solution:

At $t = 1$ s the current in the resistor is 3 mA so $\underline{v = 15 \text{ V}}$.

At $t = 4$ s the current in the resistor is 0 A so $\underline{v = 0 \text{ V}}$.



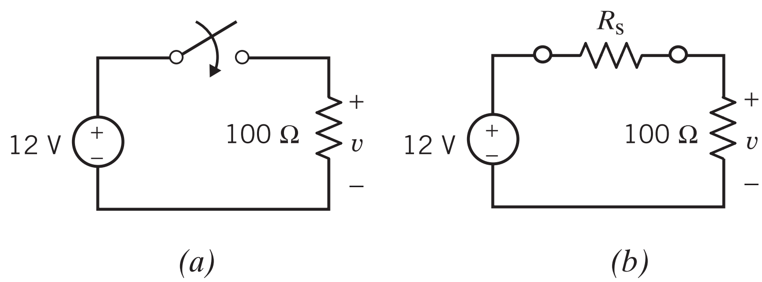


Figure P 2.9-3

P 2.9-3 Ideally an open switch is modeled as an open circuit and a closed switch is modeled as a closed circuit. More realistically, an open switch is modeled as a large resistance and a closed switch is modeled as a small resistance.

Figure P 2.9-3*a* shows a circuit with a switch. In figure P 2.9-3*b* the switch has been replaced with a resistance. In figure P 2.9-3*b* the voltage *v* is given by

$$v = \left(\frac{100}{R_s + 100} \right) 12$$

Determine the value of *v* for each of the following cases.

(a) The switch is closed and $R_s = 0$ (a short circuit).
(b) The switch is closed and $R_s = 5\ \Omega$.
(c) The switch is open and $R_s = \infty$ (an open circuit).
(d) The switch is open and $R_s = 10\ \text{k}\Omega$.

Solution:

(a) $v = 12$ V

(b) $v = \left(\frac{100}{105} \right) 12 = 11.43$ V

(c) $v = 0$ V

(d) $v = \left(\frac{100}{10100} \right) 12 = 0.1188 \simeq 0.12$ V