Chapter 2 Circuit Elements

Exercises

Exercise 2.4-1 Find the power absorbed by a 100-ohm resistor when it is connected directly across a constant 10-V source.
Answer: 1-W

Solution:
$$P = \frac{v^2}{R} = \frac{(10)^2}{100} = \underline{1 \text{ W}}$$

Exercise 2.4-2 A voltage source $v = 10 \cos t$ V is connected across a resistor of 10 ohms. Find the power delivered to the resistor.
Answer: $10 \cos^2 t$ W

Solution:
$$P = \frac{v^2}{R} = \frac{(10 \cos t)^2}{10} = \underline{10 \cos^2 t \text{ W}}$$

Exercise 2.7-1 Find the power absorbed by the CCCS in Figure E 2.7-1.

Hint: The controlling element of this dependent source is a short circuit. The voltage across a short circuit is zero. Hence, the power absorbed by the controlling element is zero. How much power is absorbed by the controlled element?

Answer:–115.2 watts are absorbed by the CCCS. (The CCCS delivers +115.2 watts to the rest of the circuit.)

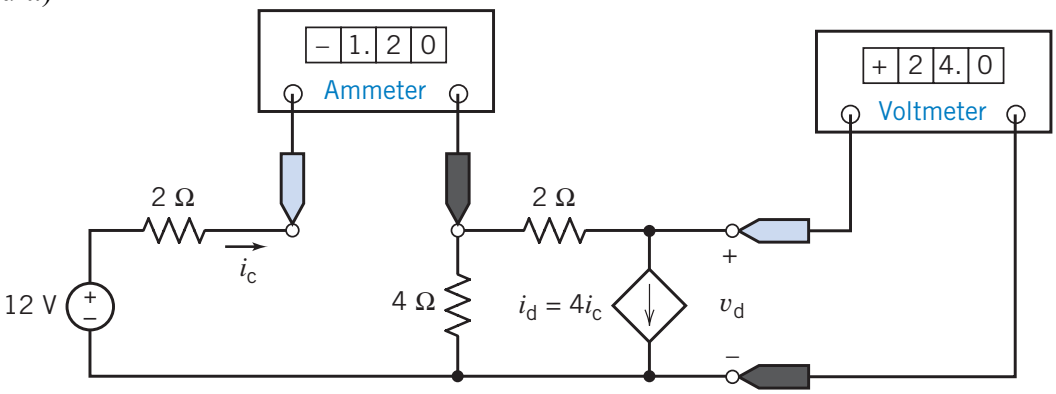

Figure E 2.7-1

Solution:

$$i_c = -1.2 \quad \text{A}, \; v_d = 24 \quad \text{V}$$
$$i_d = 4\,(-1.2) = -4.8 \quad \text{A}$$

i_d and v_d adhere to the passive convention so

$$P = v_d\, i_d = (24)\,(-4.8) = \underline{-115.2 \quad \text{W}}$$

is the power received by the dependent source

Exercise 2.8-1 For the potentiometer circuit of Figure 2.8-2, calculate the meter voltage, v_m, when $\theta = 45°$, $R_p = 20$ kΩ, and $I = 2$ mA.

Answer: $v_m = 5$ V

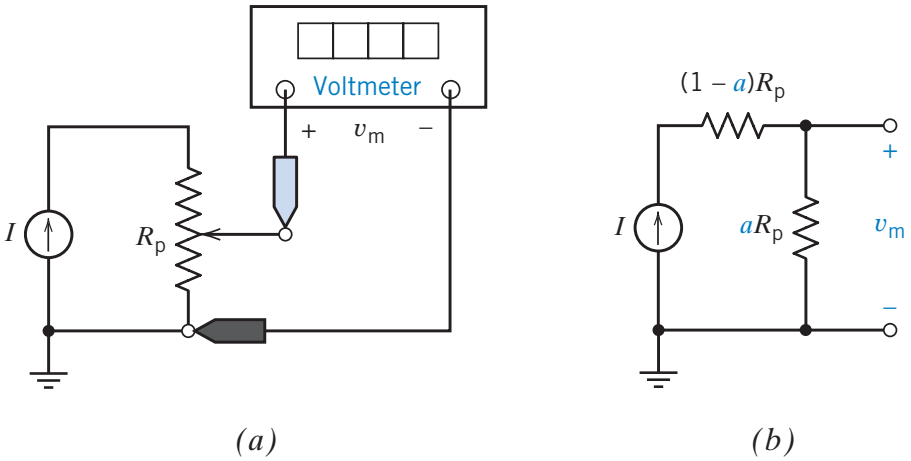

Figure 2.8-2

Solution:

$$\theta = 45^\circ,\ I = 2\ \text{mA},\ R_p = 20\ \text{k}\Omega$$

$$a = \frac{\theta}{360} \quad \Rightarrow \quad a\,R_p = \frac{45}{360}(20\ \text{k}\Omega) = 2.5\ \text{k}\Omega$$

$$v_m = (2\times10^{-3})(2.5\times10^{3}) = \underline{5\ \text{V}}$$

Exercise 2.8-2 The voltage and current of an AD590 temperature sensor of Figure 2.8-3 are 10 V and 280 μA, respectively. Determine the measured temperature.

Answer: $T = 280$°K, or approximately 6.85°C

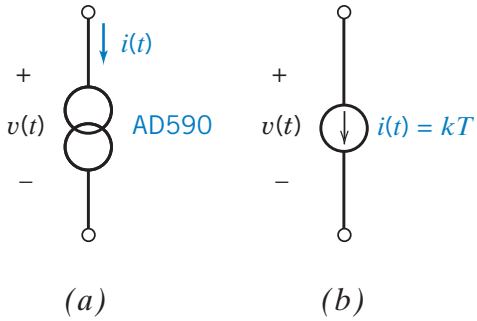

Figure 2.8-3

Solution:

$$v = 10\ \text{V},\ i = 280\ \mu\text{A},\ k = 1\frac{\mu\text{A}}{^\circ\text{K}}\ \text{for AD590}$$

$$i = kT \quad \Rightarrow \quad T = \frac{i}{k} = (280\mu\text{A})\left(1\ \frac{^\circ\text{K}}{\mu\text{A}}\right) = \underline{280^\circ\ \text{K}}$$

Exercise 2.9-1 What is the value of the current i in Figure E 2.9-1 at time $t = 4$ s?

Answer: $i = 0$ amperes at $t = 4$ s (both switches are open).

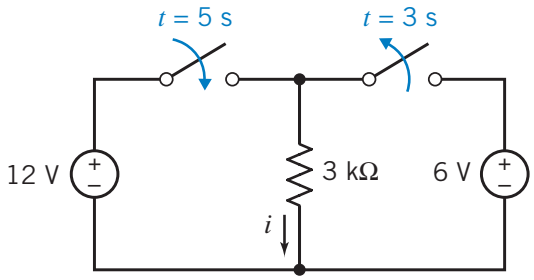

Figure E 2.9-1

Solution:

At $t = 4$ s both switches are open, so $i = 0$ A.

Exercise 2.9-2 What is the value of the voltage v in Figure E 2.9-2 at time $t = 4$ s? At $t = 6$ s?

Answer: $v = 6$ volts at $t = 4$ s, and $v = 0$ volts at $t = 6$ s.

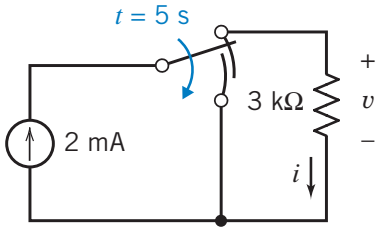

Figure E 2.9-2

Solution:

At $t = 4$ s the switch is in the up position, so $v = i\,R = (2\text{ mA})(3\text{ k}\Omega) = \underline{6\text{V}}$.

At $t = 6$ s the switch is in the down position, so $v = 0$ V.