1.8 Five coulombs of charge pass through the element in Fig. P1.8 from point *A* to point *B*. If the energy absorbed by the element is 120 J, determine the voltage across the element.

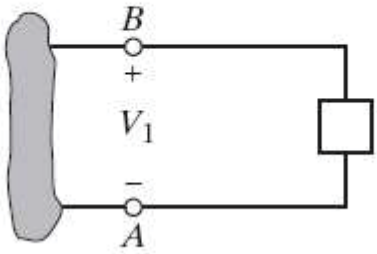


Figure P1.8

SOLUTION:

$$W = -V_1 Q$$

$$V_1 = -\frac{W}{Q}$$

$$V_1 = -\frac{120}{5}$$

$$V_1 = -24\,V$$

1.16 The charge that enters the BOX in Fig. P1.16 is shown in the graph below. Calculate and sketch the current flowing into and the power absorbed by the BOX between 0 and 10 milliseconds.

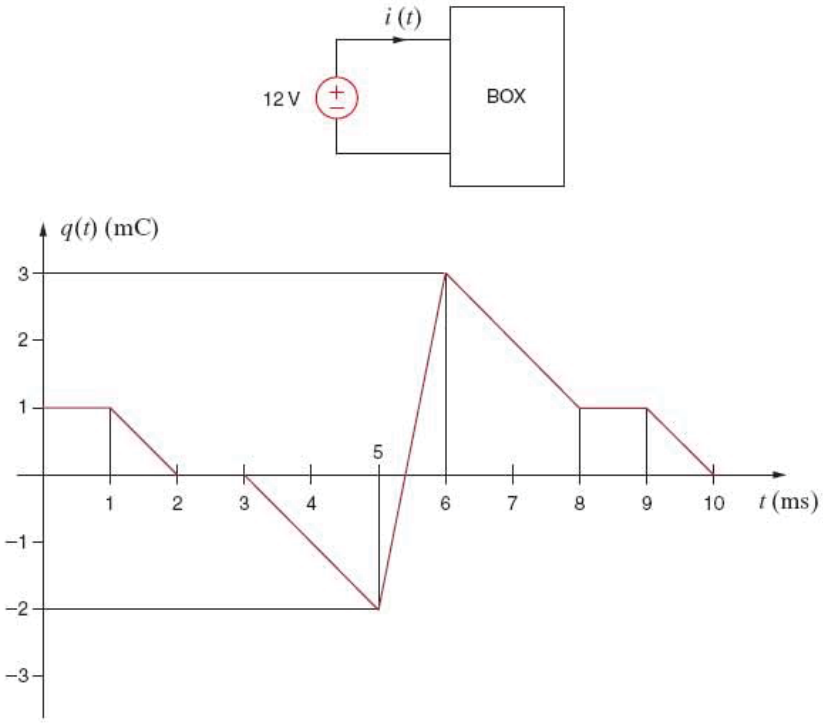


Figure P1.16

SOLUTION:

$$i(t) = \frac{dq}{dt} \text{ (slope of the curve)}$$

$$P = vi = 12i$$

$0 \le t \le 1$ ms:

$$i(t) = \frac{1-1}{1-0} = 0 \qquad P = 12(0) = 0$$

$1 \le t \le 2$ ms:

$$i(t) = \frac{0-1}{2-1} = -1\text{A} \qquad P = (12)(-1) = -12\text{ W}$$

$2 \le t \le 3$ ms:

$$i(t) = \frac{0-0}{3-2} = 0 \qquad P = 0$$

$3 \le t \le 5$ ms:

$i(t) = \frac{-2-0}{5-3} = -1\,A \quad p = (12)(-1) = -12\,W$

$5 \le t \le 6$ ms:

$i(t) = \frac{3-(-2)}{6-5} = 5\,A \quad p = (12)(5) = 60\,W$

$6 \le t \le 8$ ms:

$i(t) = \frac{1-3}{8-6} = -1\,A \quad p = (12)(-1) = -12\,W$

$8 \le t \le 9$ ms:

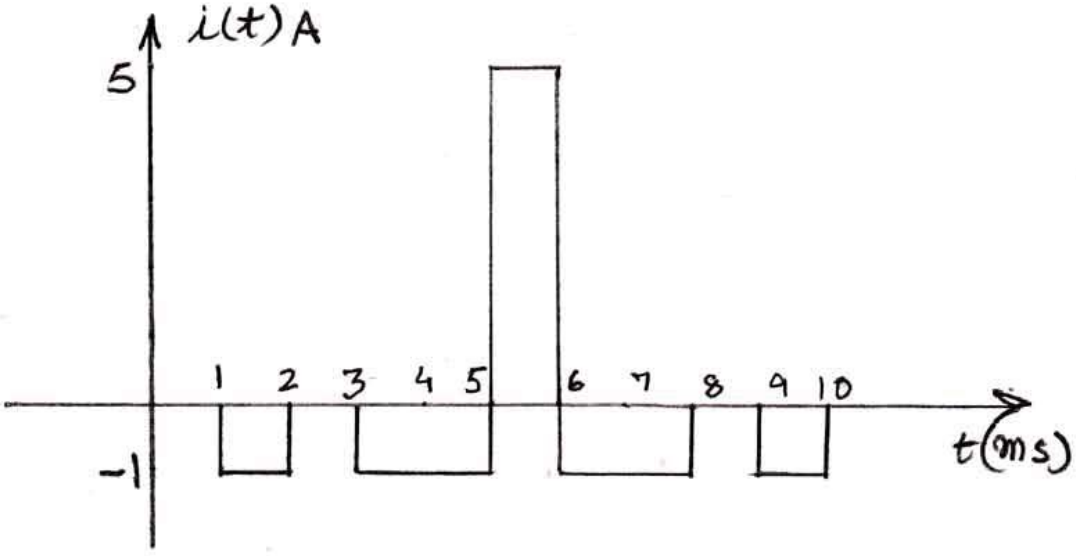
$i(t) = \frac{1-1}{9-8} = 0 \quad p = (12)(0) = 0$

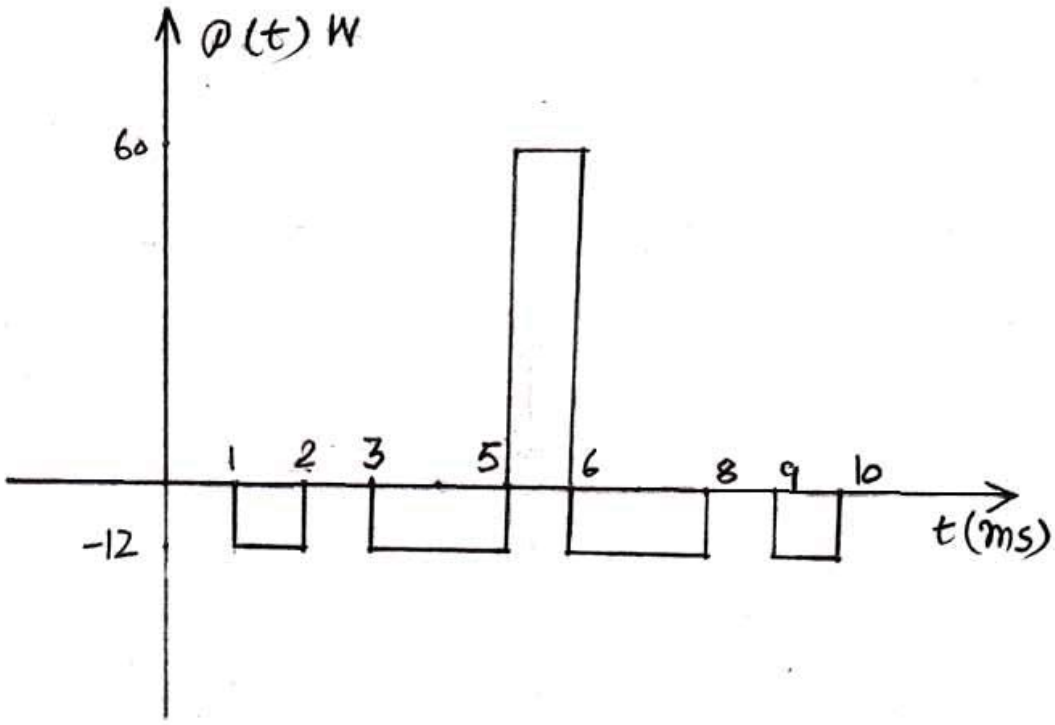
$9 \le t \le 10$ ms:

$i(t) = \frac{0-1}{10-9} = -1\,A \quad p = (12)(-1) = -12\,W$

$t > 10$ ms:

$i(t) = 0 \quad p = 0$




p(t) W
60
-12
1
2
3
5
6
8
9
10
t(ms)

1.21 Calculate the power absorbed by element A in Fig. P1.21.

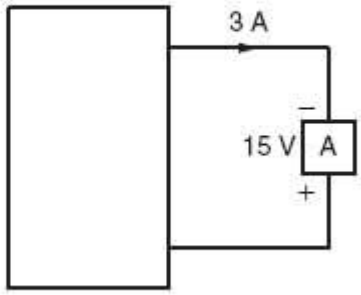
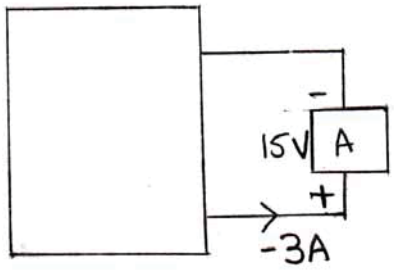


Figure P1.21

SOLUTION:



$$p = (15)(-3) = -45\,w$$

1.27 **(a)** In Fig. P1.27 (a), $P_1 = 36$ W. Is element 2 absorbing or supplying power, and how much?

(b) In Fig. P1.27 (b), $P_2 = -48$ W. Is element 1 absorbing or supplying power, and how much?

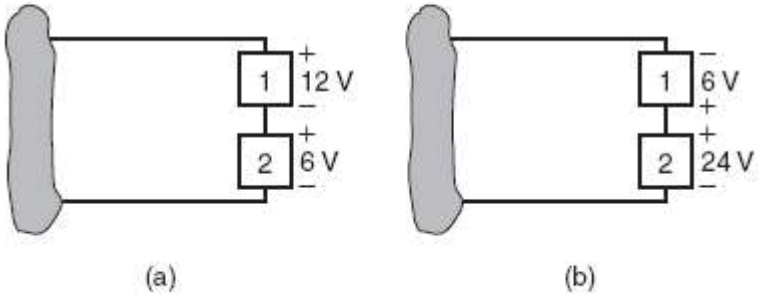


Figure P1.27

SOLUTION:

a) $P_1 = 36\ W$

$$I = \frac{P_1}{V}$$

$$I = \frac{36}{12}$$

$$I = 3A$$

$$P_2 = V_2\, I$$

$$P_2 = 6(3)$$

$P_2 = 18\ W$ absorbed

b) $P_2 = -48\,W$

$$I = \frac{P_2}{-V_2}$$

$$I = \frac{-48}{-24}$$

$$I = 2A$$

$$P_1 = V_1 I$$

$$P_1 = 6(2)$$

$P_1 = 12\,W$ absorbed.

1.30 Choose I_s such that the power absorbed by element 2 in Fig. P1.30 is 7 W.

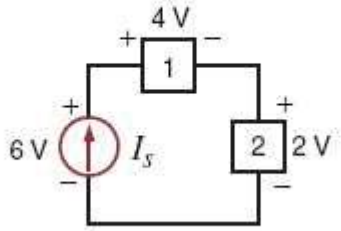


Figure P1.30

SOLUTION:

$P_2 = 7\text{W}$ absorbed

$P_2 = V_2 I_S$

$I_S = \frac{P_2}{V_2} = \frac{7}{2}$

$I_S = 3.5\text{A}$

1.36 Determine the power absorbed by element 1 in Fig. P1.36.

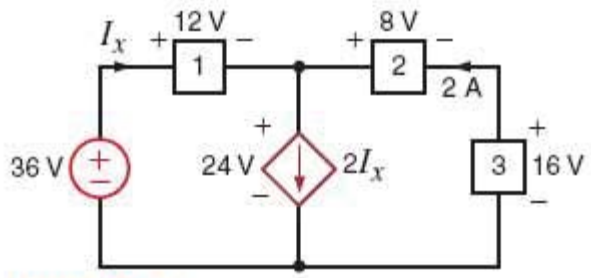


Figure P1.36

SOLUTION:

$$P_{36V} = -36I_x\ W$$
$$P_1 = 12I_x\ W$$
$$P_{2I_x} = 48I_x\ W$$
$$P_2 = -16\ W$$
$$P_3 = -32\ W$$

$$36I_x + 16 + 32 = 12I_x + 48I_x$$
$$48 = 24I_x$$
$$I_x = 2A$$

$$P_1 = 24\ W$$

2.2 Determine the current and power dissipated in the resistors in Fig. P2.2.

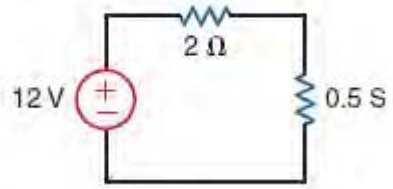


Figure P2.2

SOLUTION:

$R_2 = \frac{1}{0.5} = 2\,\Omega$

$I = \frac{12}{2+2}$

$I = 3A$

$P_{R_1} = I^2 R_1 = (3)^2(2)$

$P_{R_1} = 18\,W$

$P_{R_2} = I^2 R_2 = (3)^2(2)$

$P_{R_2} = 18\,W$

2.8 An automobile uses two halogen headlights connected as shown in Fig. P2.8. Determine the power supplied by the battery if each headlight draws 3 A of current.

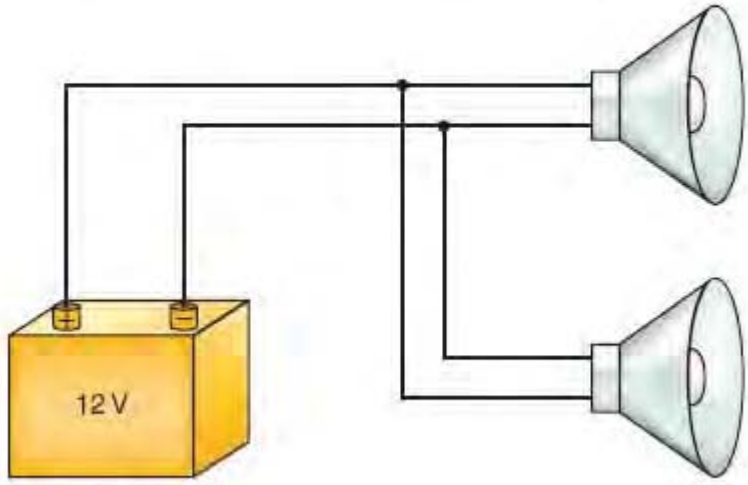


Figure P2.8

SOLUTION:

$I_1 = I_2 = 3A$

$I = I_1 + I_2 = 6A$

$P_{12V} = VI = 12(6)$

$P_{12V} = 72\ W$

2.10 Find I_1 in the network in Fig. P2.10.

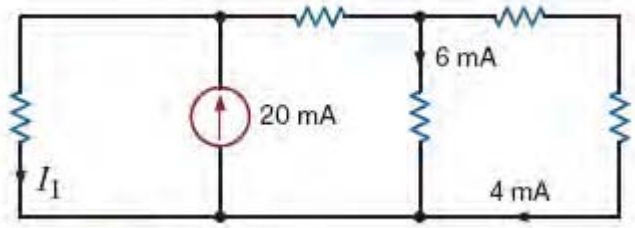


Figure P2.10

SOLUTION:

KCL at mode B: $I_2 = 6m + 4m$

$I_2 = 10m\ A$

KCL at mode A: $I_1 + I_2 = 20m$

$I_1 = 20m - 10m$

$I_1 = 10m\ A$

2.13 Find I_1 in the circuit in Fig. P2.13.

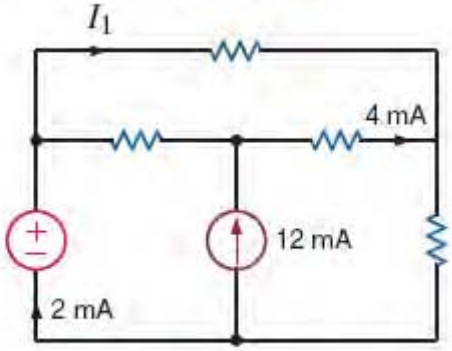
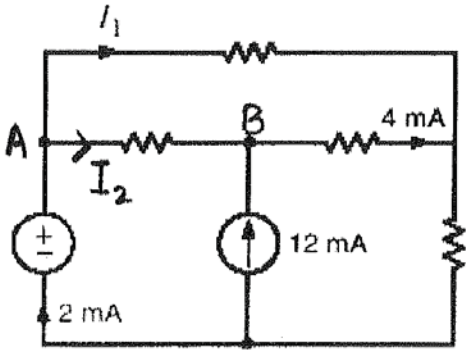


Figure P2.13

SOLUTION:



KCL at node B: $I_2 + 12m = 4m$

$I_2 = -8mA$

KCL at node A: $2m = I_1 + I_2$

$I_1 = 10mA$

2.15 Determine I_L in the circuit in Fig. P2.15.

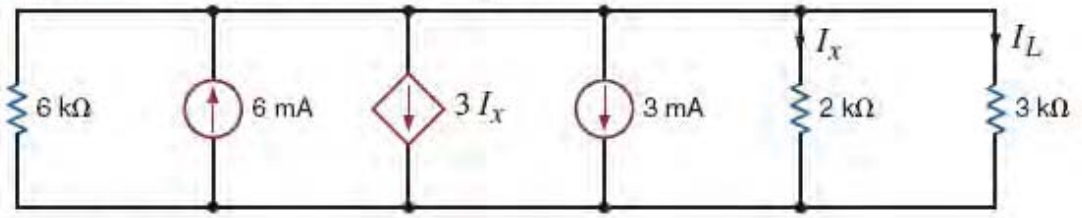


Figure P2.15

SOLUTION:

$$6m = \frac{V}{6k} + 3I_x + 3m + I_x + I_L$$

$$\frac{V}{6k} + 4I_x + I_L = 3m$$

$$I_x = \frac{V}{2k} \quad \text{and} \quad I_L = \frac{V}{3k}$$

$$\frac{V}{6k} + 4\left(\frac{V}{2k}\right) + \frac{V}{3k} = 3m$$

$$V + 12V + 2V = 18$$

$$15V = 18$$

$$V = \frac{18}{15}\,V$$

$$I_L = \frac{18}{15(3k)}$$

$$I_L = 0.4mA$$

2.17 Find I_1 in the network in Fig. P2.17.

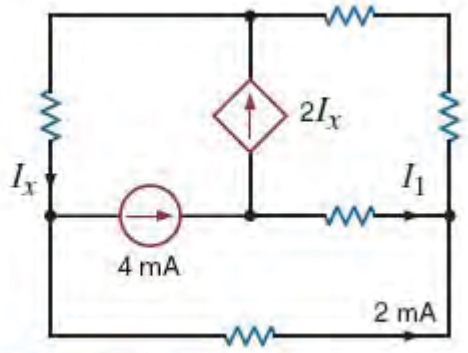


Figure P2.17

SOLUTION:

$$I_x = 4\,mA + 2\,mA = 6\,mA$$

$$4\,mA = 2I_x + I_1$$

$$= 12\,mA + I_1$$

$$I_1 = -8\,mA$$

2.25 Find V_{fb} and V_{ec} in the circuit in Fig. P2.25.

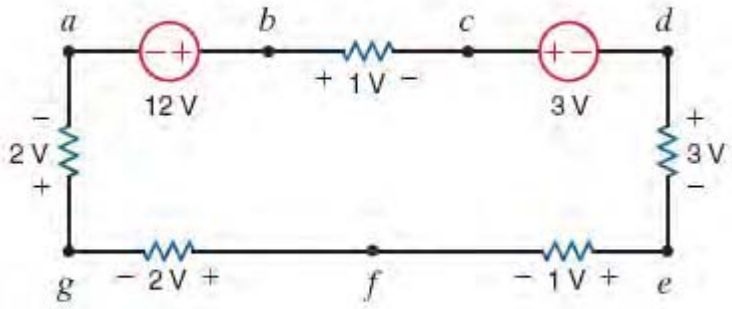


Figure P2.25

SOLUTION:

KVL around fbcdef:

$V_{fb} + 1 + 3 + 3 + 1 = 0$

$V_{fb} = -8\,V$

KVL around ecde:

$V_{ec} + 3 + 3 = 0$

$V_{ec} = -6\,V$

2.31 Find V_o in the network in Fig. P2.31.

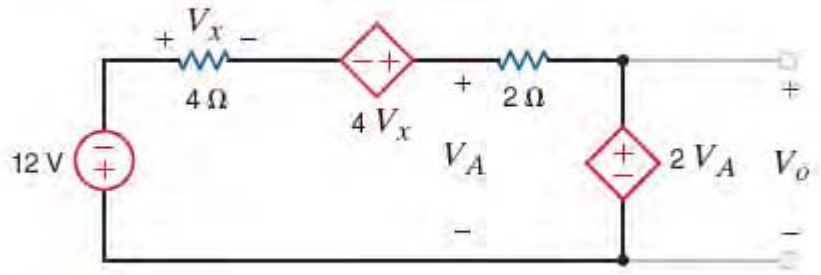


Figure P2.31

SOLUTION:

KVL : $4V_x = 12 + 4I + 2I + 2V_A$

$V_x = 4I$

$4(4I) = 12 + 6I + 2V_A$

$2V_A = 10I - 12$

$V_A = 5I - 6$

KVL : $4V_x = 12 + V_x + V_A$

$4(4I) = 12 + 4I + V_A$

$V_A = 12I - 12$

$I = \frac{V_A + 12}{12}$

$V_A = 5\left(\frac{V_A + 12}{12}\right) - 6$

$12V_A = 5V_A + 60 - 12$

$7V_A = -12$

$V_A = -\frac{12}{7}\ V$

$V_o = 2V_A = 2\left(-\frac{12}{7}\right) = -\frac{24}{7}\ V$

2.40 Find V_x and the power supplied by the 15-V source in the circuit in Fig. P2.40.

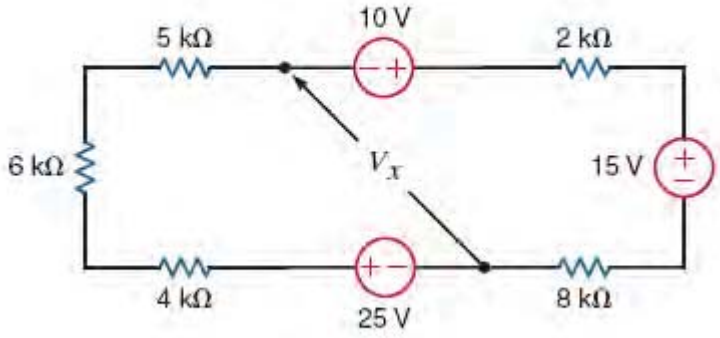


Figure P2.40

SOLUTION:

KVL : $25+10 = 4KI + 6KI + 5KI + 2KI + 15 + 8KI$

$25KI = 20$

$I = 0.8\,mA$

KVL : $V_x + 10 = 2KI + 15 + 8KI$

$V_x = 5 + 10K(0.8m)$

$V_x = 13V$

$P_{15V} = VI = 15(0.8m)$

$P_{15V} = 12\,mW$ (absorbed)