Nathapat Kittisuth 6681368 * Solutions are in next pages *

Submitted by……Nathapat……………… * I am not sure all most all of Question *

1) = 10
2) = 10
3) = 10
4) = 5
5) = 10
6) = 5
7) = 10
8) = 8
9) = 5
10) = 5
78/100

1. When a car has a dead battery, it can often be started by connecting the battery from another car across its terminals. The positive terminals are connected together as are the negative terminals. The connection is illustrated in Fig. 1.1. Assume the current *i* in Fig. 1.1 is measured and found to be 30 A.

a) Which car has the dead battery? ⇒ A ✓

b) If this connection is maintained for 1 min, how much energy is transferred to the dead battery? i=30A t=60s V=12 P= 30(60)(12) = 21,600 J ✓ 10

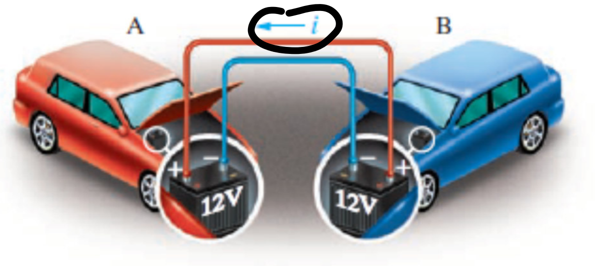

Fig. 1.1

2. The voltage and current at the terminals of the circuit element in Fig 1.2 are zero for $t < 0$. For $t \geq 0$, they are

$$i = 15te^{-500t} \text{ A}, \qquad t \geq 0.$$
$$v = 80{,}000te^{-500t} \text{ V}, \qquad t \geq 0;$$

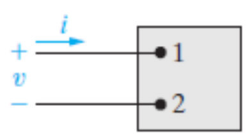

Fig. 1.2

a) Find the time when the power delivered to the circuit element is maximum.
b) Find the maximum value of power.

3. Determine the power absorbed by each of the elements in Fig. 1.3

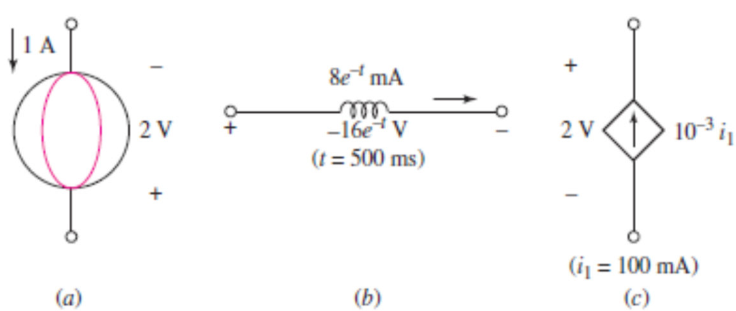

Fig. 1.3

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4. Find the resistor R_{T1} and R_{T2} in Fig 4 in term of resistors.

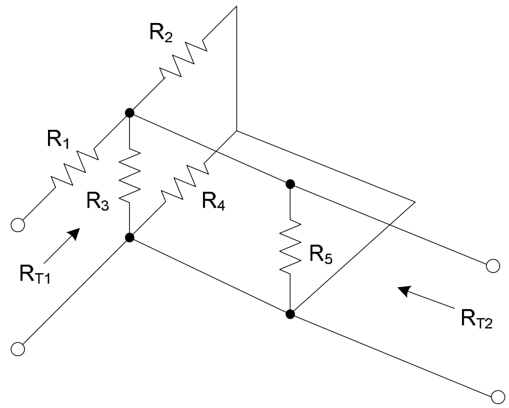

Fig. 1.4

5. The charge that enters the BOX is shown in Fig. 1.5. Calculate and sketch the current flowing into the BOX between 0 and 10 milliseconds.

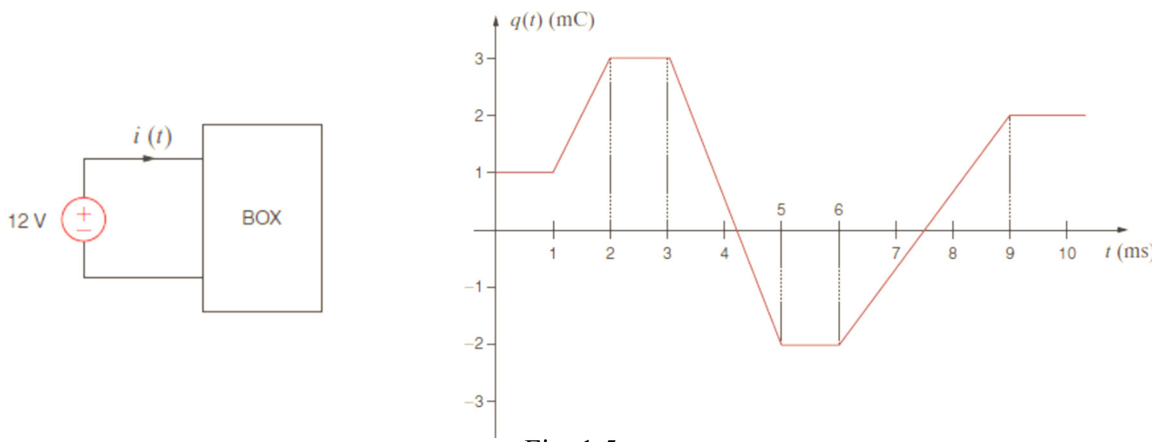

Fig. 1.5

6. Find the v_{R2} and v_2 if v_{R1} = 1V.

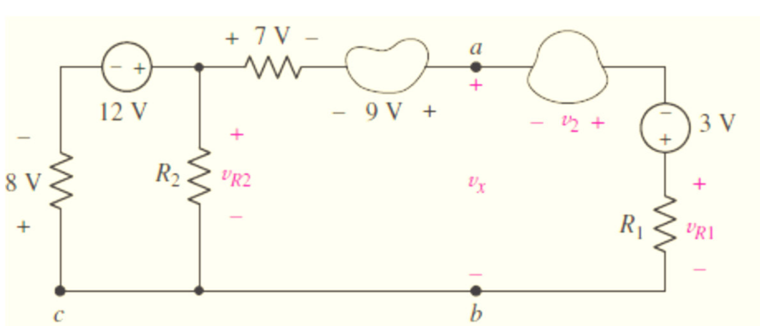

Fig. 1.6

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7. Determine v_x for the circuit in Fig. 1.7.

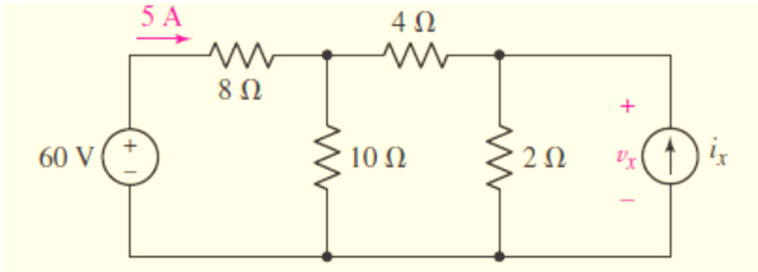

Fig. 1.7

8. The numerical values of the voltages and currents in the interconnection seen in Fig. 1.8 are given in Table 8. Identify the load and source for each device and show the interconnection satisfy the power check (power conservation).

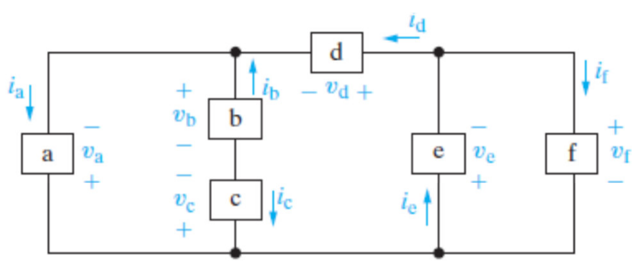

Fig. 1.8

Table 8

Element	Voltage (kV)	Current (μA)
a	−3	−250
b	4	−400
c	1	400
d	1	150
e	−4	200
f	4	50

9. For the circuit shown in Fig 1.9 find

(a) The current i_1 in microamperes.

(b) The voltage v in volt.

(c) The total power generated.

(d) The total power absorbed.

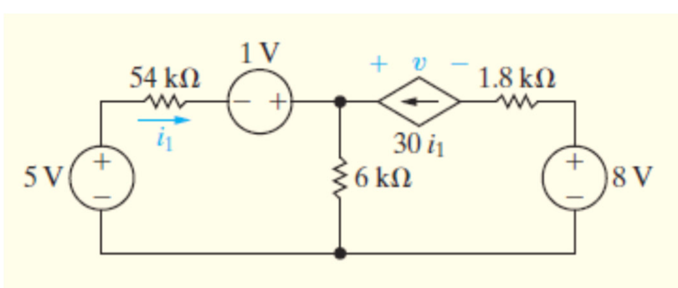

Fig 1.9

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1.10 The currents i_a and i_b in the circuit in Fig. 1.10 are 4 A and - 2A respectively.

a) Find i_g.

b) Find the power dissipated in each resistor.

c) Find v_g.

d) Show that the power delivered by the current source is equal to the power absorbed by all the other elements.

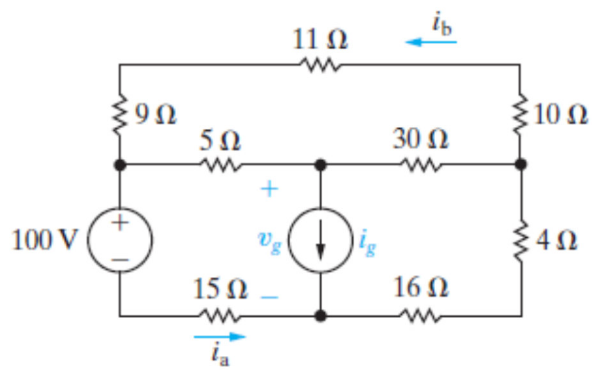

Fig. 1.10

2)

$P(t) = IV$

$= (15 + e^{-500t})(8\times10^{4}\, t e^{-500t})$

$= 120\times10^{4}\, t^{2} e^{-1000} t$

$P'(t) = 1.2\times10^{6}\left(t^{2}(-1000)e^{-1000t} + 2te^{-1000t}\right) = 0$

$\cancel{(1.2\times10^{6})}\cancel{(e^{-1000t})}\,[2t - 1000t^{2}] = 0$

$t(2 - 1000t) = 0$

$t = 0, \frac{2}{1000}$

$\therefore t = 2\ \text{ms}$

$P(t) = 1.2\times10^{6}\, t^{2} e^{-1000t}$

$P(0.002) = 0.6494\ \text{W}$ Ans

10

3)

a) $P = IV$

$= (1)(2) = 2\ \text{W}$

$= -2\ \text{W}.$

b) $P = IV$

$= (8e^{-t}\times10^{-3})(-16e^{-t})$

$= 8e^{-500\times10^{-3}}\times10^{-3}\,(-16e^{-500\times10^{-3}})$

$= -0.047\ \text{W}$

c) $P = IV$

$= 10^{-3}(100\times10^{-3})(2$

$= 2\times10^{-4}\ \text{W}.$

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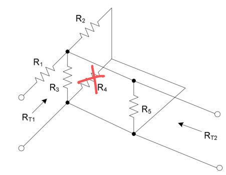
4)

4. Find the resistor R_{T1} and R_{T2} in Fig 4 in term of resistors.



Find R_{T_1}

R_1 series R_3 $=$ $R_1 + R_3 = R_{13}$

$R_{13} \parallel R_2 = \frac{1}{R_{13}} + \frac{1}{R_2} = \frac{1}{R_{T_1}}$

$\frac{R_2 + R_{13}}{R_{13}(R_2)} = \frac{1}{R_{T_1}}$

$\therefore R_{T_1} = \frac{R_{13}(R_2)}{R_2 + R_{13}}$

Find R_{T_2}

$\cancel{R_4}$ series R_5 $\Rightarrow R_4 + R_5 = R_{45}$

$R_{45} \parallel R_3 = \frac{1}{R_{45}} + \frac{1}{R_3} = \frac{1}{R_{T_2}}$

$\frac{1}{R_{T_2}} = \frac{R_3 + R_{45}}{R_{45}R_3}$

$R_{T_2} = \frac{R_{45}R_3}{R_3 + R_{45}}$

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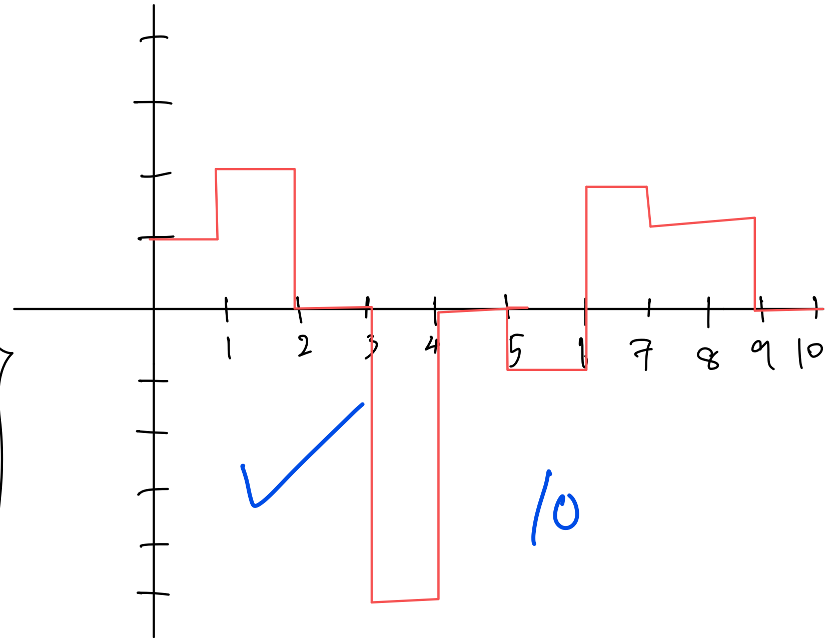
$R_{T_1} = R_1 + (R_2 \parallel R_3 \parallel R_5)$

$R_{T_2} = R_2 \parallel R_3 \parallel R_5$

5) $i = \frac{\Delta Q}{\Delta t}$

T	q(t)	i
$0 \to 1$	$0 \to 1$	$\frac{1-1}{1-1} = 1$
$1 \to 2$	$1 \to 3$	$\frac{3-1}{2-1} = 2$
$2 \to 3$	$3 \to 3$	0
$3 \to 4$	$3 \to -2$	-5
$4 \to 5$	$-2 \to -2$	0
$5 \to 6$	$-2 \to -3$	-1
$6 \to 7$	$-3 \to -1$	2
$7 \to 9$	$-1 \to 2$	1.5
$9 \to 10$	$2 \to 2$	0



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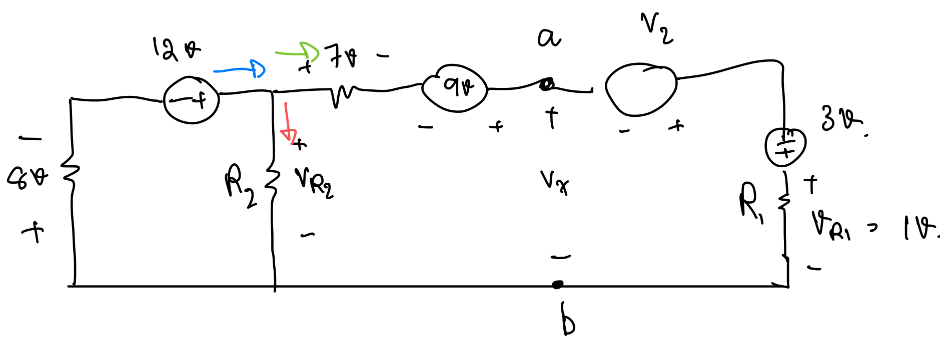
6)



$$+7V - 9V - V_2 + 1V - 3V = 0$$

$$V_2 = 4V \text{ Ans.}$$

$$V_{R_2} = V_2 = 4V \text{ Ans}$$

$V_2 = -8$

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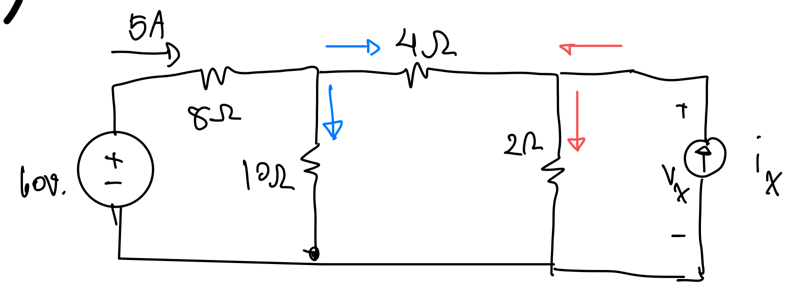
7)



$v. = 5(8) = 40V.$

$\Rightarrow 60 - 40 = 20V.$

$\Rightarrow$ V connect $4\Omega; 8\Omega, 10\Omega = 20\,V.$

$$I_{4\Omega} = \frac{20 - V_x}{4}$$

$$I_{2\Omega} = \frac{V_x}{2}$$

$$\therefore \quad \frac{20 - V_x}{4} = \frac{V_x}{2} + i_x$$

$$I_{10\Omega} = \frac{20-0}{10} = 2A$$

5A From 8Ω 2A From 10Ω

$$\therefore \quad \frac{20 - V_x}{4} = 3$$

$V_x = 8$ Ans.

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8)

8. The numerical values of the voltages and currents in the interconnection seen in Fig. 1.8 are given in Table 8. Identify the load and source for each device and show the interconnection satisfy the power check (power conservation).

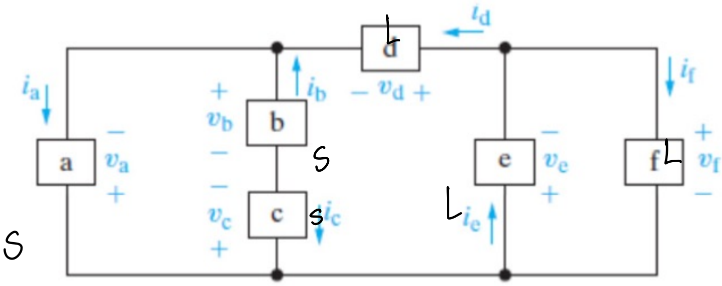

Fig. 1.8

Table 8

Element	Voltage (kV)	Current (μA)
a	−3	−250
b	4	−400
c	1	400
d	1	150
e	−4	200
f	4	50

P_a : source $= -(-250\mu)(-3) = -750$ mW

P_b = source load $-(iv)$ $= -(4)(-400) = 1600$ mW

P_c = source $= -1(400) = -400$ mW

P_d = load $= 1(150 = 150$ mW

P_e = Load source iv $= -4(200) = -800$ mW

P_f = Load $= 4(50) = 200$ mW

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$P_{total} = -750 + 1600 - 400 + 150 - 800 + 200 = 0$ W.

9)

9. For the circuit shown in Fig 1.9 find
(a) The current i_1 in microamperes.
(b) The voltage v in volt.
(c) The total power generated.
(d) The total power absorbed.

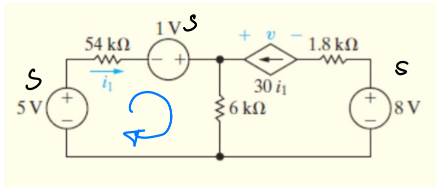

Fig 1.9

(a) $-5V + (54\times10^3)\, i_1 - 1 = 0$

$i_1 = \frac{6}{54\times10^3}$

$= 111.1\ \mu A$ 25 μA

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(b) $V = 30 i_1 = 3.33$ −2V

(c) $5(111.1\times10^{-6}) + 1\times(111.1\times10^{-6}) = 0.667$ mW 6150 mW

8V-source $V = 3.33$ ∴ $i = \frac{3.33}{1.8k} = 1.85$ mA

∴ $P = 8(1.85\times10^{-3}) = 14.8$ mW

∴ $P_{total} = 14.8 + 0.667 = 15.467$ mW

(d) $R\,(54\,\Omega) = P = i^2R = (111.1\times10^{-6})^2 \cdot 54k = 0.667$ mW

$R\,(6k\Omega) = (111.1\times10^{-3})^2\,(6\,\Omega) = 0.0074$

Depentsource [$V = 3.33$, $i = 1.85$ mA)

$P = 6.1605$

$P_{total} = 6.9015$ mW

10)

1.10 The currents i_a and i_b in the circuit in Fig. 1.10 are 4 A and -2A respectively.

a) Find i_g.

b) Find the power dissipated in each resistor.

c) Find v_g.

d) Show that the power delivered by the current source is equal to the power absorbed by all the other elements.

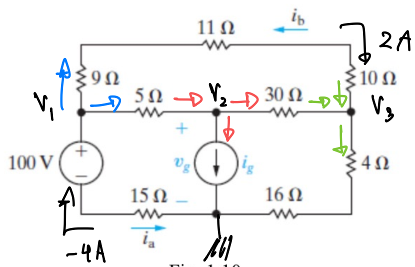

Fig. 1.10

(a) $V_1 = 100V$

KCL @ V_1: $-4 = \frac{(V_1 - V_3)}{9} + \frac{(V_1 - V_2)}{5}$

KCL @ V_2: $\frac{V_1 - V_2}{5} = i_g + \frac{(V_2 - V_3)}{30}$

KCL @ V_3: $\frac{V_2 - V_3}{30} + 2 = \frac{V_3}{20}$

$\therefore \; i_g = -8.4$ A

$-9A$

(b) ⇒ 15, 16 $i_a = 4$ A

$P_{15} = (4^2)(15) = 240$

$P_{16} = (16)(16) = 256$

⇒ 11Ω $i_b = -2$ A

$P_{11} = (4)(11) = 44$

⇒ 10Ω, 4Ω $i_g = -8.4$ A

$P_{10} = 705.6$

$P_4 = 282.24)$

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(c) $V_g = i_a(15+16) = 124V$

190 V

$V_g = 124$

1710 W

$P_{deli} = 124.4 = 496$ W.

Power absorb ⇒ 240+256 + 44 + 40+16 + 40 + 120

= 756 W.