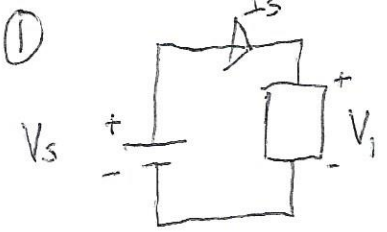
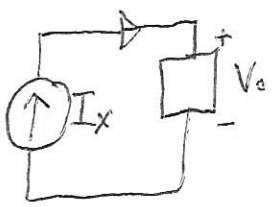
① 



Given:
$I_s = 3A$
$P_1 = 6W$

$I_x = g V_1$
$g = 2 A/V$
$V_o = 5V$

Find P_o

Steps:

(a) Find V_1

$P_1 = I_s V_1 \Rightarrow \frac{P_1}{I_s} = V_1$

$V_1 = \frac{6W}{3A} = 2V$

(b) Find I_x

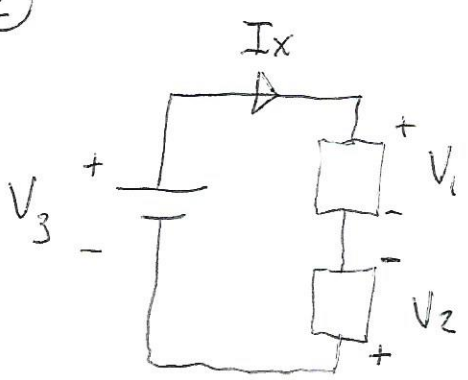
$I_x = g V_1$

$I_x = (2A/V)(2V)$
$= 4A$

(c) Find P_o

$P_o = I_x V_o$
$= (4A)(5V)$
$= 20W$

(2)



Given:

$P_3 = -8W \quad I_x = 5mA$

$P_1 = 3W$

Find V_1, V_2, V_3

(a) Find P_2

$$P_1 + P_2 + P_3 = 0$$

$$P_2 = -P_1 - P_3$$
$$= 8W - 3W$$
$$= 5W$$

(b) Find V_1, V_2, V_3

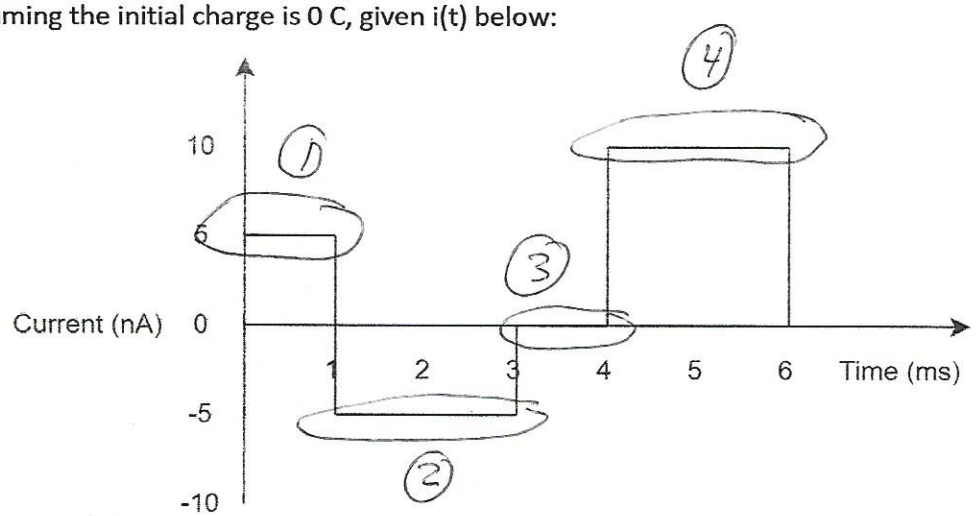
$$V_1 = \frac{P_1}{I_x} = \frac{3W}{5mA} = \frac{3}{5}\,kV = 0.6\,kV$$

$$V_2 = -\frac{P_1}{I_x} = -\frac{5W}{5mA} = -1\,kV$$

$$V_3 = \frac{P_3}{I_x} = -\left(\frac{-8W}{5mA}\right) = 1.6\,kV$$

(3) $q_a = 0\ C$

Plot q(t), assuming the initial charge is 0 C, given i(t) below:



(1) $q_b = q_a + I_1(\Delta t_1)$

$= 0 + (5nA)(1ms)$

$= 5pC$

(2) $q_c = q_b + I_2(\Delta t_2)$

$= 5pC + (-5nA)(2ms)$

$= -5pC$

(3) $q_d = q_c + I_3(\Delta t_3)$

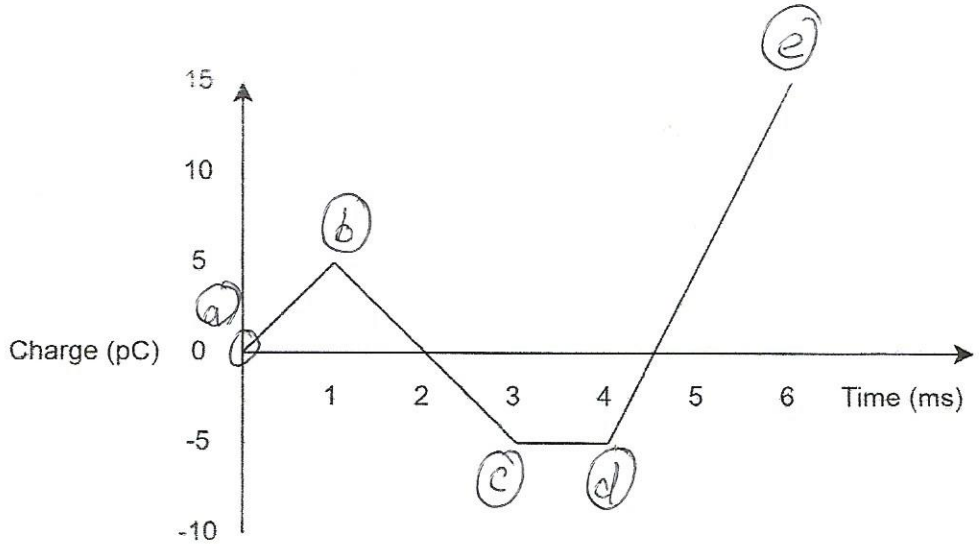
$= -5pC + 0(1ms)$

$= -5pC$

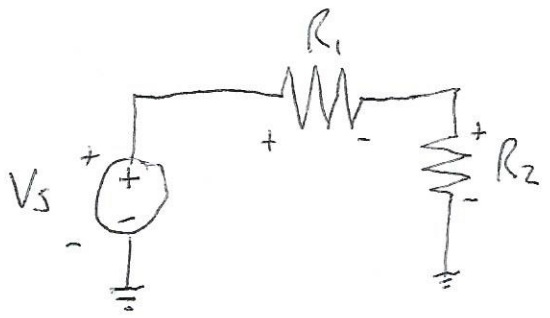
(4) $q_e = q_d + I_4(\Delta t_4)$

$= -5pC + (10nA)(2ms)$

$= 15pC$



(4)



Given:

$V_S = 5V$

$P_2 = 5W$

$R_1 = R_2 = R$

Find I_x, R

(a) Find V_1, V_2

KVL:

$V_1 + V_2 - V_S = 0$

We know: $I_1 = I_2 = I_x$ and $R_1 = R_2$

$\therefore V_1 = I_1 R_1 = I_x R_2 = V_2$ or $V_1 = V_2$

sub into KVL:

$V_1 + V_1 = V_S$

$V_1 = \frac{1}{2} V_S = 2.5V$

$V_2 = 2.5V$

(b) Find I_x

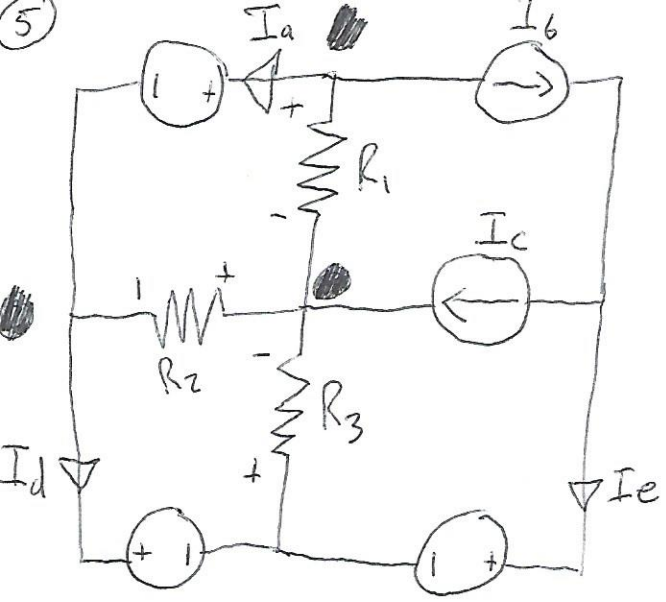
$$I_x = \frac{P_2}{V_2} = \frac{5W}{2.5V} = 2A$$

(c) Find R

$V_1 = I_x R$

$$R = \frac{V_1}{I_x} = \frac{2.5V}{2A} = 1.25\,\Omega$$

(5)

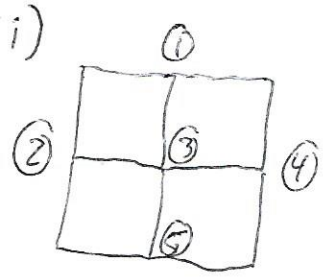


Given:
$V_2 = 4V$
$I_c = 7A$
$I_d = 3A$
$I_e = 2A$
$R_2 = 2\Omega$

Find:
i) # of branches, nodes, and independent loops.
ii) KCL equation for each node
iii) I_1, I_2, I_3, I_a, I_b

i) branches = 8 loops = 4 check: $b = l + n - 1$ $\therefore$ LHS = RHS ✓
nodes = 5 $8 = 4 + 5 - 1 = 8$

i)



* Assuming PSC and current entering nodes are +ve

① $0 = -I_a - I_b - I_1$
② $0 = I_a + I_2 - I_d$
③ $0 = I_1 - I_2 + I_c + I_3$
④ $0 = I_b - I_c - I_e$
⑤ $0 = I_d - I_3 + I_e$

iii) Find I_2

$$I_2 = \frac{V_2}{R_2} = \frac{4V}{2\Omega} = 2A$$

Find I_b

Eq. ④
$I_b = I_c + I_e$
$= 9A$

→ Find I_3

Eq. ⑤
$I_3 = I_d + I_e$
$= 5A$

Find I_a

Eq. ②
$I_a = I_d - I_2$
$= 1A$

→ Find I_1

Eq. ①
$I_1 = -I_a - I_b$
$= -10A$

check:
Eq. ③
$0 = (-10A) - 2A + 7A + 5A$
$0 = 0$ $\therefore$ LHS = RHS ✓