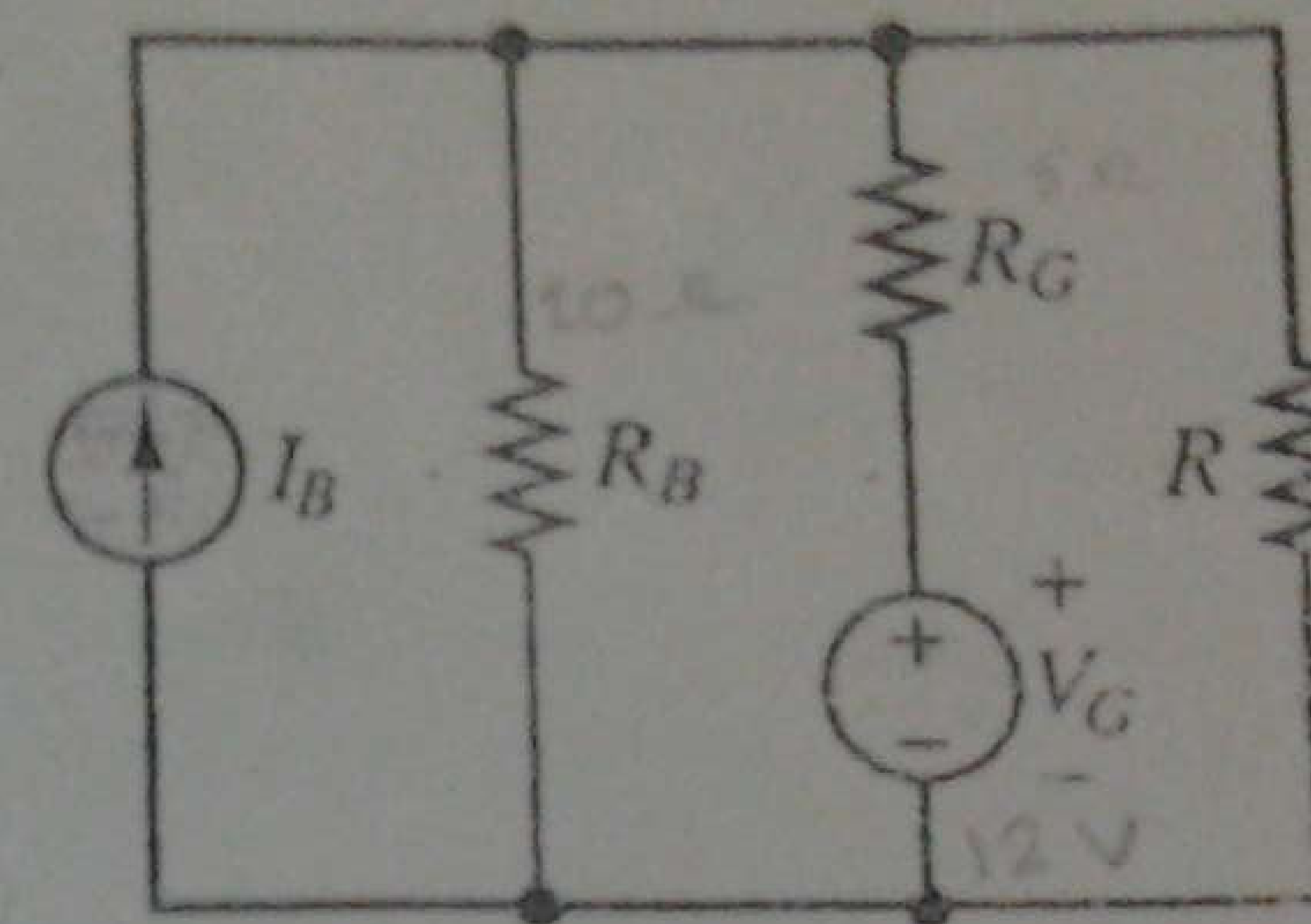
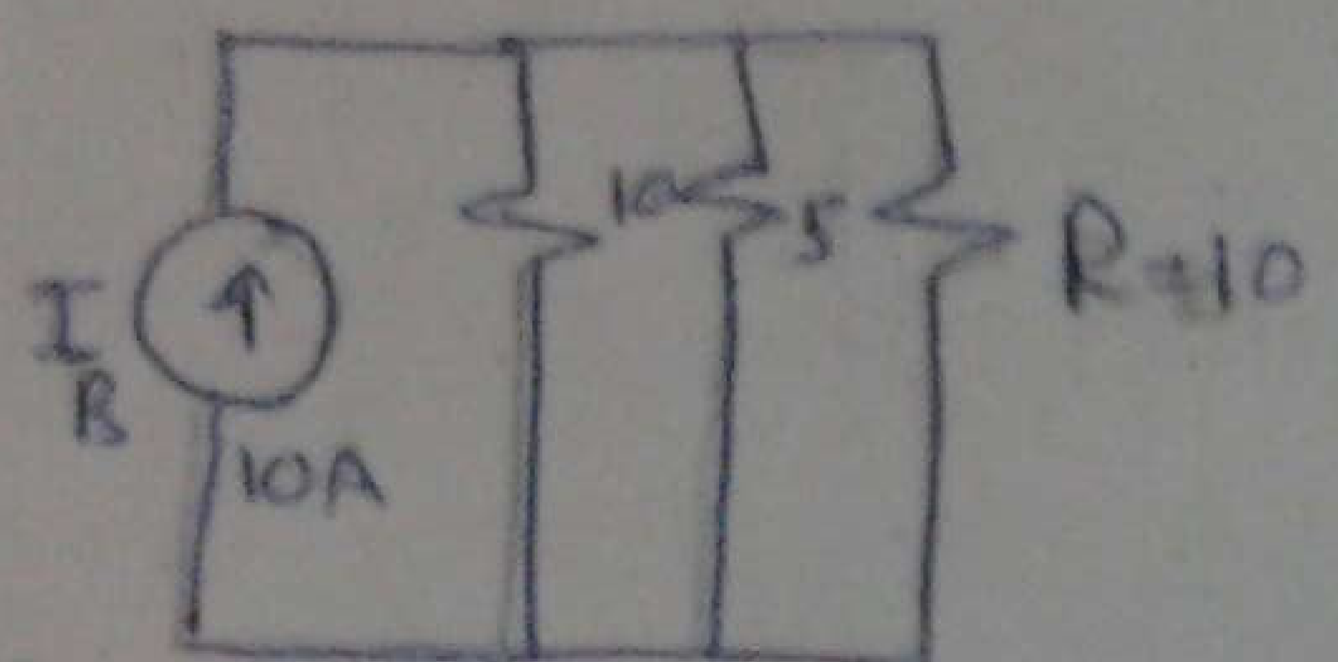
Q1-(7Pts) For the circuit shown, where: $I_B = 10A$, $V_G = 12V$, $R_G = 5\Omega$, $R_B = R = 10\Omega$. By using **superposition**, <u>**determine**</u> the:

a- **Voltage** across R. b- **Power** dissipated in R.

c- Can be used the **superposition** method for power calculations, and **why**?



a)

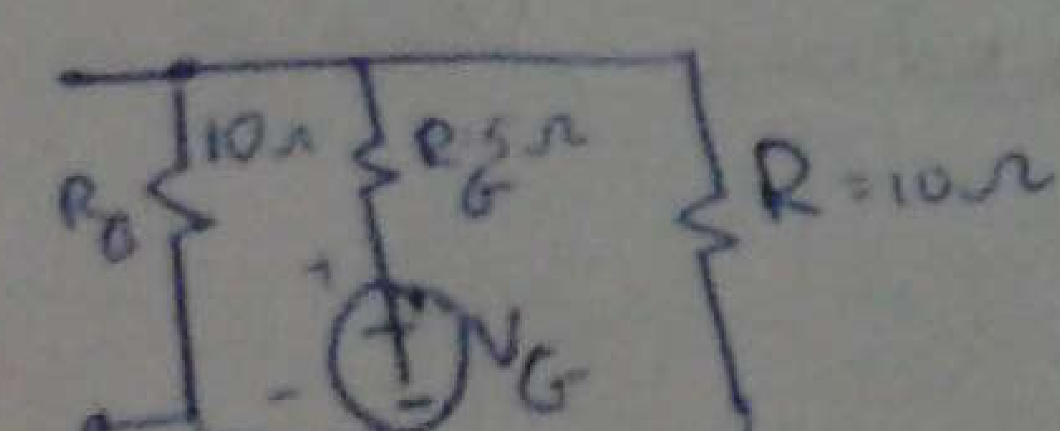


$$\frac{1}{R_{eq}} = \frac{1}{10} + \frac{1}{5} + \frac{1}{10} = \frac{4}{10} \rightarrow R_{eq} = 2.5\,\Omega$$

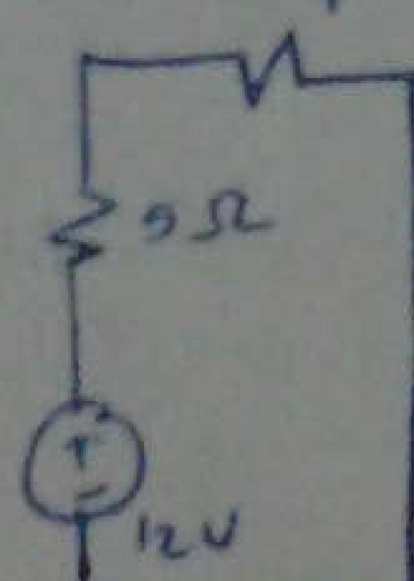
$\rightarrow V = (10)(2.5) = 25\,V = V_{R_B} = V_{R_G} = V_R$

$$\boxed{V_{R_{short}} = 25\,V}$$

I_B open $\rightarrow$



$\Rightarrow$



$eq = \frac{1}{10} + \frac{1}{10} = 5\,\Omega$

$\Leftarrow$ Voltage devider

$$V'_{R_{open}} = V_G \frac{R_{eq}}{R_{eq} + R_G} = 12\frac{5}{10} = \boxed{6\,V}$$

$V_{R\,total} = 6 + 25 = 31\,V$

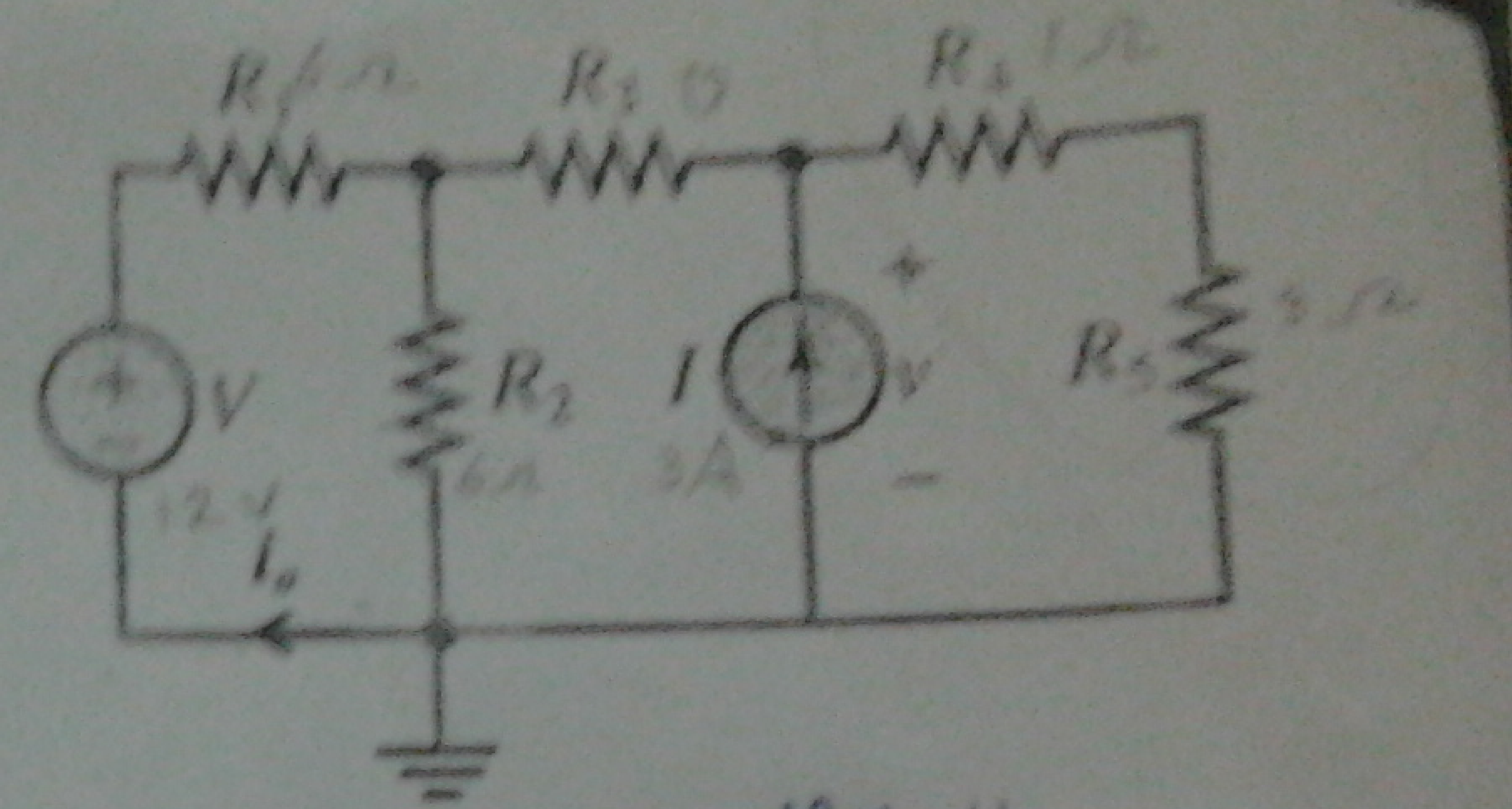
b) $P = \frac{V^2}{R} = \frac{(33)^2}{10} = 10$

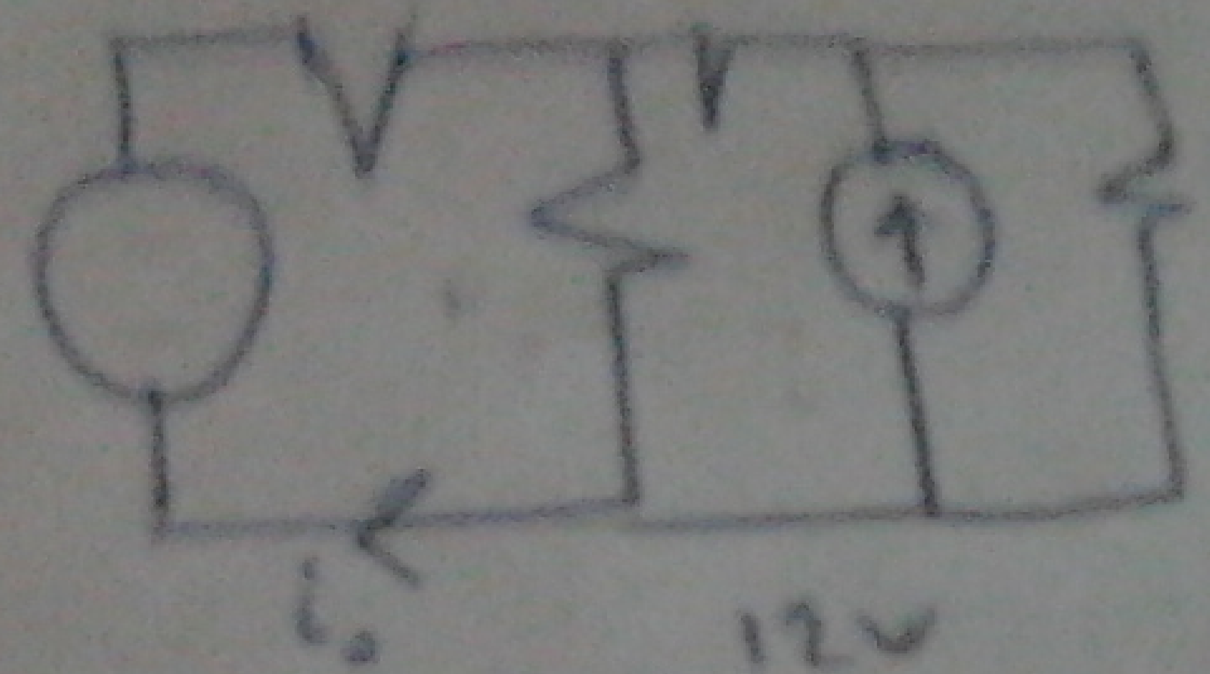
a- 31 V

b- 109 W

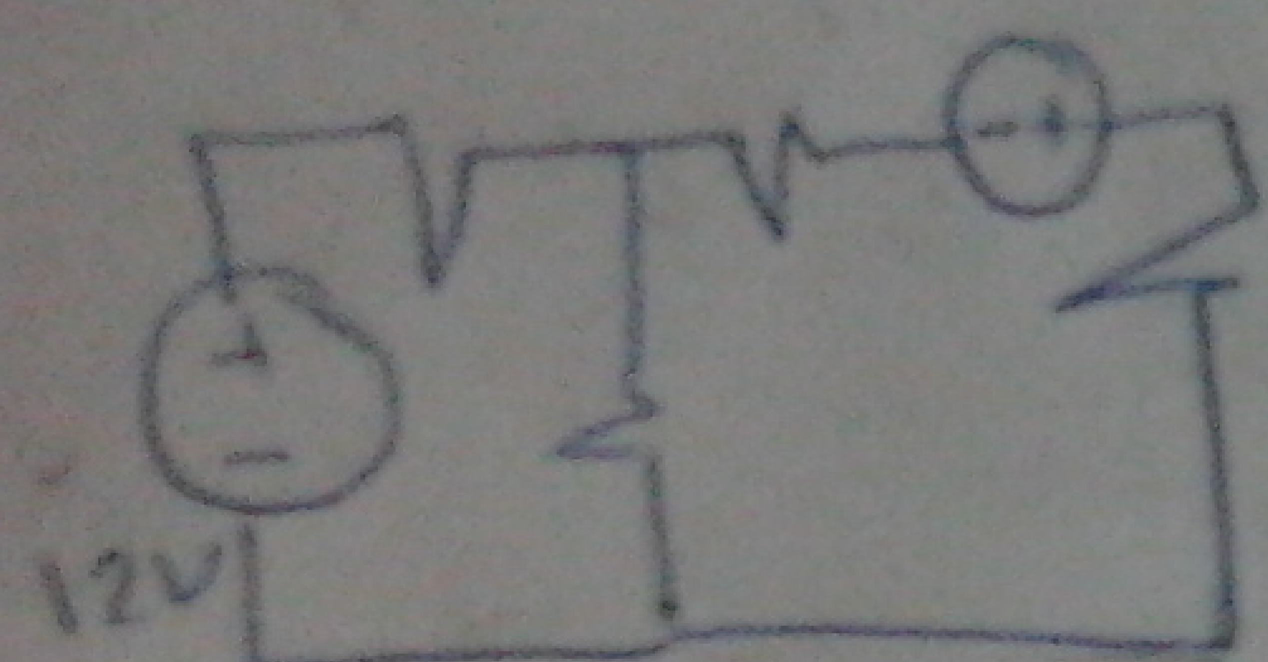
Q3-(4Pts) For the circuit shown, where: $V = 12V$, $I = 3A$, $R_1 = 6\Omega$, $R_2 = 6\Omega$, $R_3 = 0$ (zero Ω), $R_4 = 1\Omega$, $R_5 = 3\Omega$.
By using proper **Source Transformation** technique, __determine__ the:

a- Current i_o b- Voltage v across the I source.





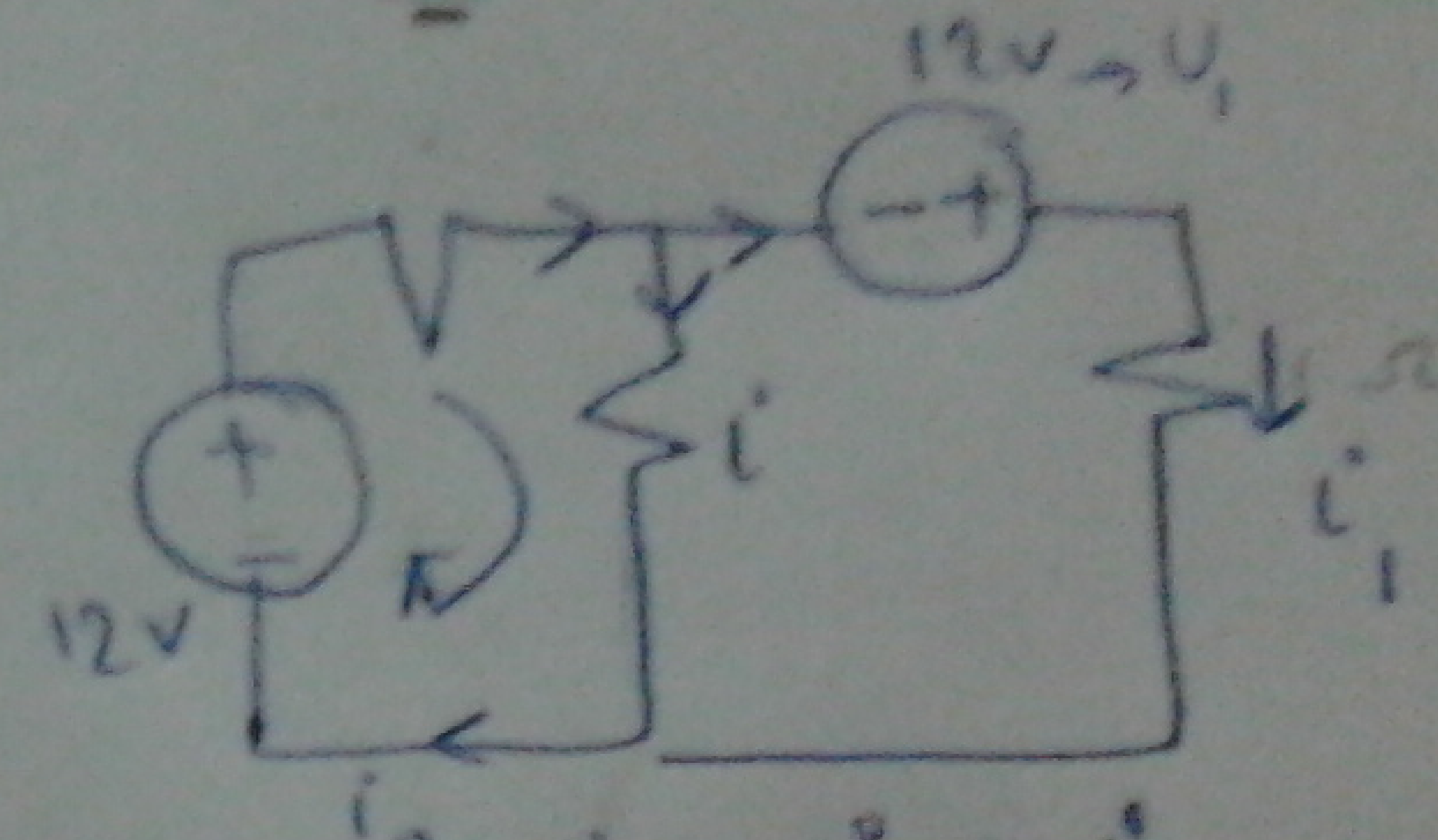
$R_{eq} = R_4 + R_5 = 4\,\Omega$



$V_1 = I R_{eq}$

$= (3)(4) = 12V \Rightarrow$

$R_{3eq} = 0 + 4 = 4\,\Omega$



$i_o = i_1 + i$

$\boxed{i = i_o - i_1}$

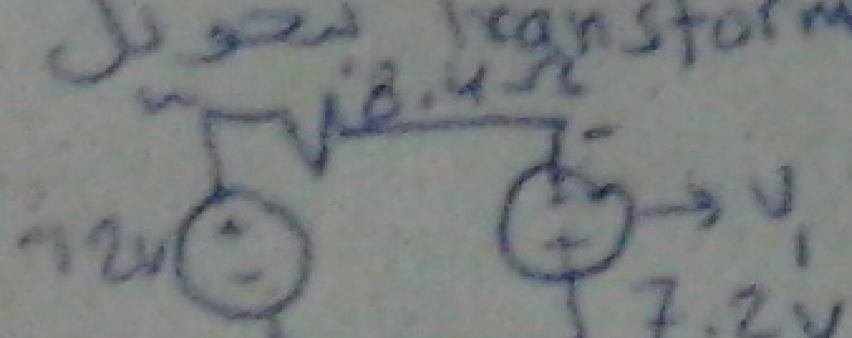
Use mesh method

$-12 + i_o(6) - 12 + 4(i_1) = 0 \rightarrow 6i_o + 4i_1 = 24$

$-12 + 6i_o + 6(i_o - i_1) = 0 \rightarrow 12i_o - 6i_1 = 12$

$\boxed{i_o = 2.29A}$

أو يمكن أن نحول الكل عن Transformation تحويل



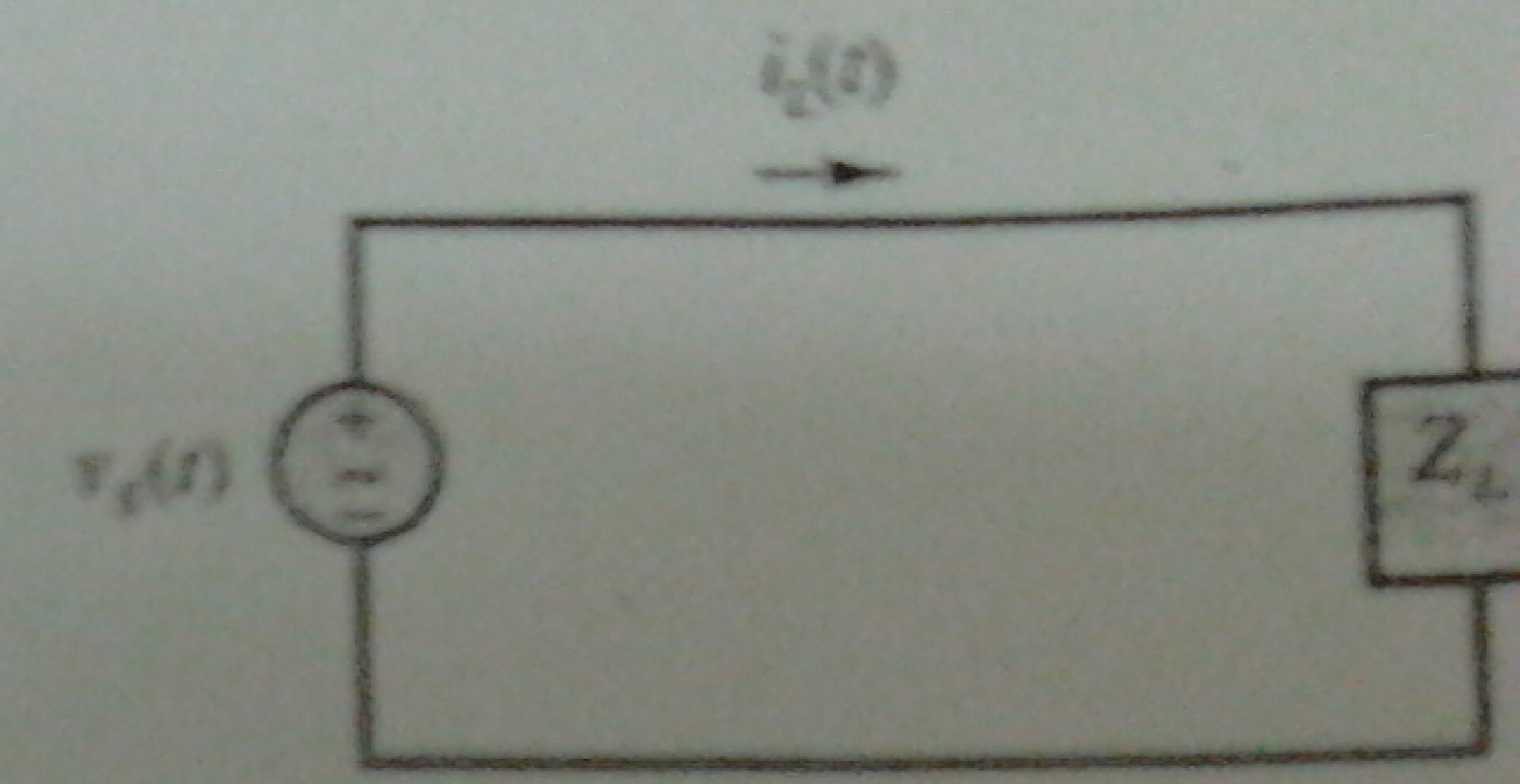
V_1 إلى I ثم إلى V ←

a- 2.3 A
b- 12 V

Q3-(6Pts) For the circuit shown, where: $v_S(t) = 311\cos(wt)$ V. $i_L(t)$

Q3- (6Pts) For the circuit shown, where: $v_S(t) = 311\cos(wt)$ V.
$i_L(t) = 2.83\sin(wt + 55°)$ A. **Determine** the:

a- rms phasor voltage. b- rms phasor current.
c- Phasor load impedance. d- Load power factor.
e- Power factor it's leading or lagging.
f- Load is Resistive, Capacitive or Inductive.



$i_L(t) = 2.83\cos(wt - 35°)$

$V_{s\,rms} = \frac{311}{\sqrt{2}} = 219.9$ V

$I_{rms} = \frac{2.83}{\sqrt{2}} = 2$ A

$Z_L = \frac{V_s}{I_s} = \frac{311\angle 0°}{2.83\angle -35°} = 109.95\angle 35°$

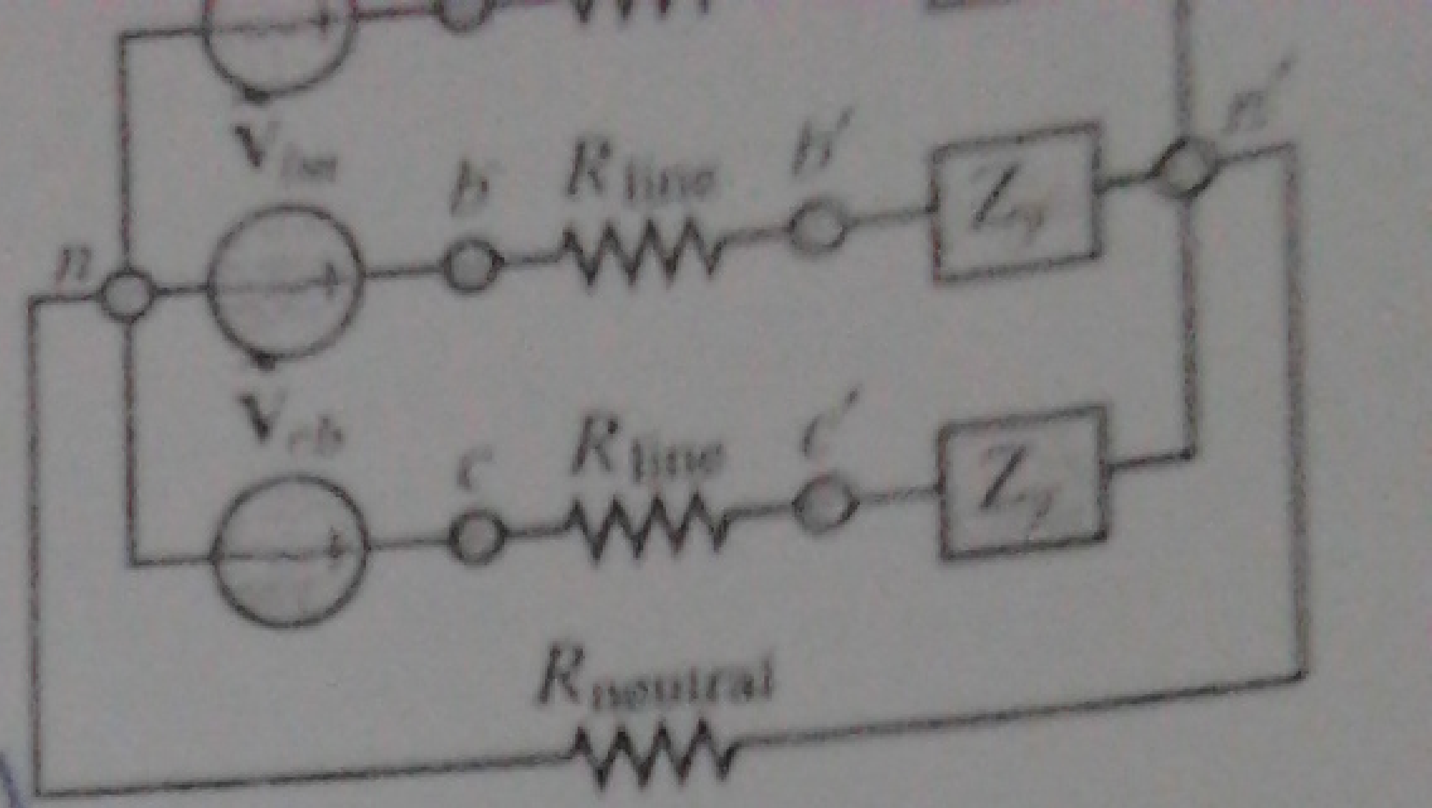
$PF = \cos(\theta_v - \theta_i) = \cos +35° = 0.82$

$\theta_Z \rightarrow$ positive $\rightarrow$ lagging $\rightarrow$ Inductive

a-	2.19 V
b-	2 A
c-	$109.9\angle -35°$
d-	0.82
e-	lagging
f-	Inductive

balanced +ve sequence (a-b-c), 50 Hz, $Z_y = 4 + j3\ \Omega$,
$R_{line} = 0.1\Omega$, $R_{neutral} = 10\Omega$. **Determine** the:

a- rms $I_{aa'}$ phasor current. b- **rms** $I_{nn'}$ phasor current.
c- Total generated **real** power. d- Power factor.
e- Total generated **complex** (apparent) power.
f- Total generated **reactive** power.
g- Total Power losses in the lines.
h- Sketch and **label** the power triangle phasor diagram.



$$I_{aa'} = I_1 = \tilde{I}_3 = \frac{\tilde{V}_{an}}{R_{line} + Z_y} = 43.3\angle{-36.2^\circ}\ A$$

b- Zero.

$$Z_y = 4 + 3j = 5\angle{36.9^\circ}\ \Omega$$

$$P_{av} = \sqrt{3}\,\tilde{I}_{LL}\tilde{V}_{LL}\cos\theta_z$$
$$\sqrt{3}(43.3)(375)\cos(36.9)$$
$$= 22.5\ KW$$

$$V_{P\text{-}L} = 220\angle 0\ \frac{4+3j}{(4+3j)+0.1} = 2$$

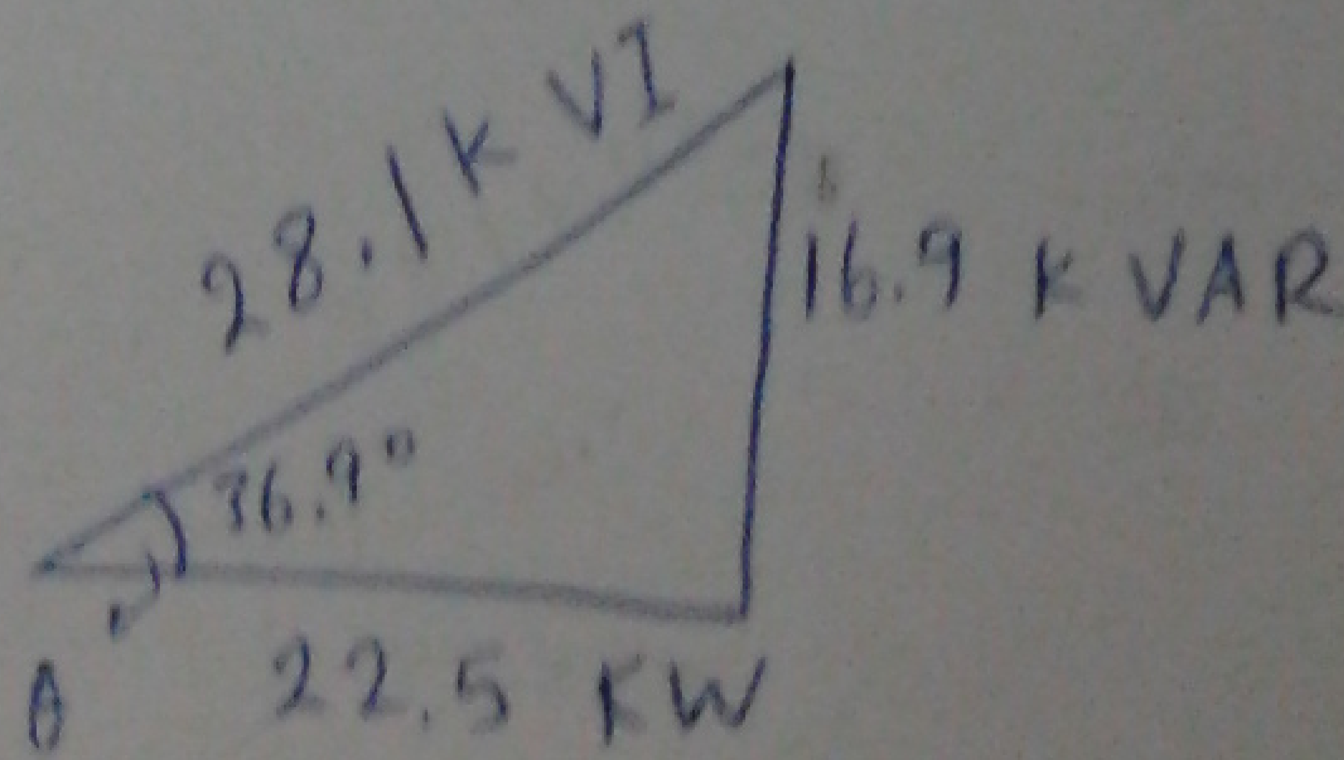
$$V_{LL} = V_{aa'} = \sqrt{3}\,V_{L\text{-}P}\ \angle 30^\circ = 375\angle$$

$$Q = \sqrt{3}\,I_{aa'}\,V_{aa}\sin\theta_z$$
$$= 16.9\ KVAR$$

$$g\text{-}\ P_L = 3 I_{aa'}^2 R_{Line}$$
$$= 562.5\ W$$

$$S_{total} = \sqrt{3}\,\tilde{V}_{aa}\,\tilde{I}_{aa'}^{*}$$
$$= (\sqrt{3})(375\angle{0.67^\circ})(43.3\angle{+36.2^\circ})$$
$$= 28.1\ KVI$$

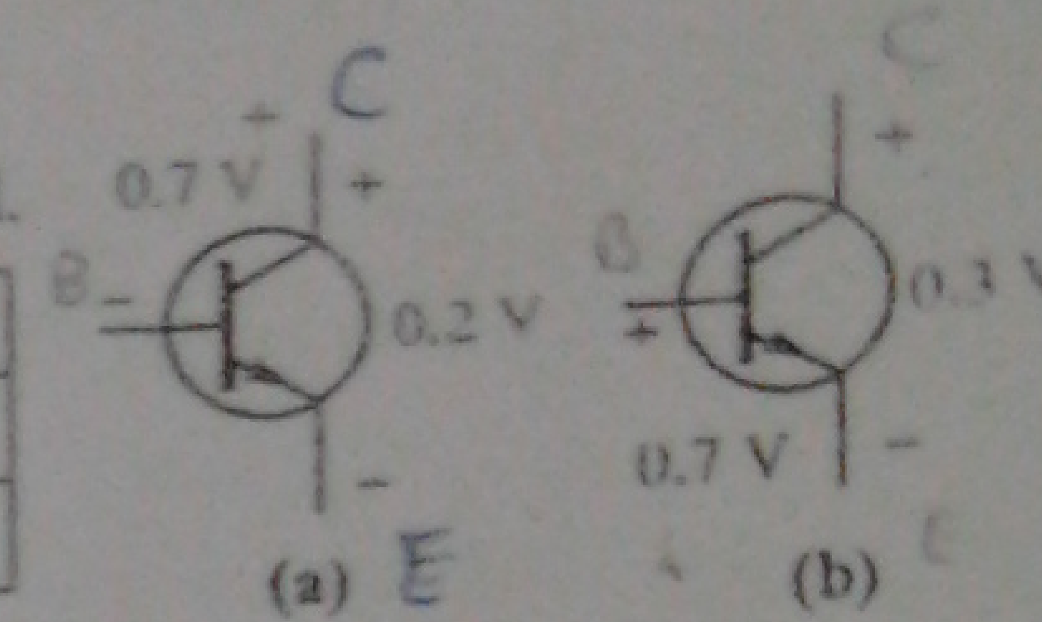
h-



a- 43.3 A
b- Zero
c- 22.5 KW
d- 0.8
e- 16.9 K VAR
f- 28.1 K VI
g- 562.5 W

Q11-*(3Pts)* For the shown BJTs, **Determine** the operating region and whether the BE and BC junctions are forward or reverse biased.

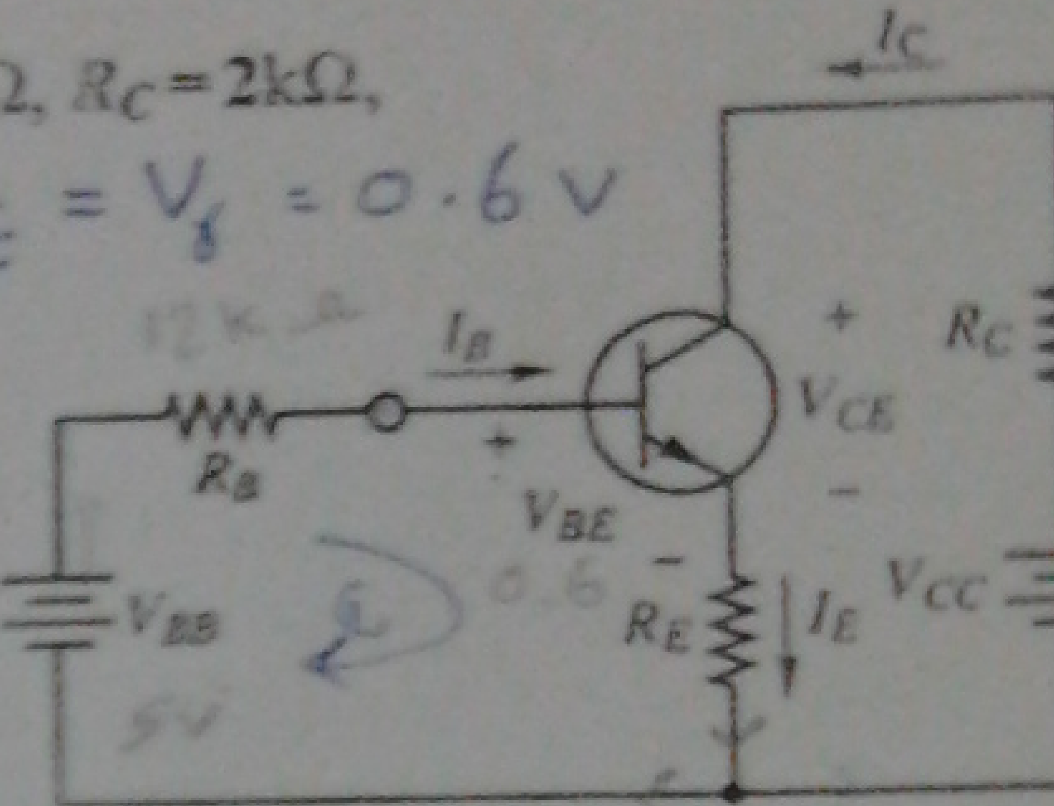
BJT	BE junction	BC junction	Operating Region
(a)	-0.5	-0.7	Cutoff
(b)	+0.7	+0.4	saturated



Q12-*(10Pts)* For the circuit shown, where: $V_{BB}=5V$, $V_{CC}=15V$, $R_B=12k\Omega$, $R_C=2k\Omega$, $R_E=1k\Omega$, $V_\gamma=0.6V$, $\beta=100$. **Determine** the:

a- **Base Current** I_B.
b- **Collector** Current I_C.
c- **Emitter** voltage V_E.
d- V_{CE} voltage.
e- **Operating** region.

$V_{BE} = V_\gamma = 0.6\,V$



Q11

a) $BC = -0.7$ reverse

$V_{CE} = V_{CB} + V_{BE}$

$0.2 = 0.7 + V_{BE}$

$V_{BE} = -0.5\ V$ reverse

b) $V_{BC} = ?$

$V_{CE} = V_{CB} + V_{BE}$

$0.3 = V_{CB} + 0.7$

$V_{CB} = -0.4 \rightarrow V_{BC} = 0.4$

loop 1 :-

$-5 + I_B R_B + V_{BE} + I_E R_E = 0$

$I_E = I_B + I_C$ plug

$\rightarrow 10^3 i_c + 13\times10^3 i_b = 4.4$

but, $\boxed{I_C = I_B \beta = 100 I_B}$ plug $\boxed{a}$

we have $I_B =$ ~~...~~ $\boxed{0.04\,mA}$ $\boxed{b}$

$I_C = (100)(0.04\times10^{-3}) = 4\,mA$

outer loop:- $-\overset{V_{BB}}{5} + R_B I_B + V_{BC} - R_C I_C + V_{CC} = 0$

$-5 + (12\times10^3)(0.04\times10^{-3}) + V_{BC} - (2\times10^3)(4\times10^{-3}) + 15 = 0$

$V_{BC} = -2.5\ V$ (reverse)

$V_{BE} = +0.6$ (forward)

e- $\boxed{\text{Active Region}}$

d- $V_{CE} = V_{CB} + V_{BE}$
$= 2.5 + 0.6$
$= 3.1\ V$

c $V_E = I_E R_E$
$= (I_B + I_C) R_E$
$= 4\ V$

a-	0.04 mA
b-	4 mA
c-	4 V
d-	3.1 V
e-	active

Q14-(4Pts) a- **Fill** in the blank cells in the table by a proper result depends on the **rules** of Boolean algebra.

Boolean Algebra	Result	Boolean Algebra	Result
$0+X$	X	$X.\overline{X}$	1
$1+X$	1	$X+X.Z$	X
$X+X$	X	$X.(X+Y)$	X
$X.X$	X	$X+\overline{X}.Y$	X+Y

b- Use **Truth** table to prove that $= AB + \overline{A}B$.

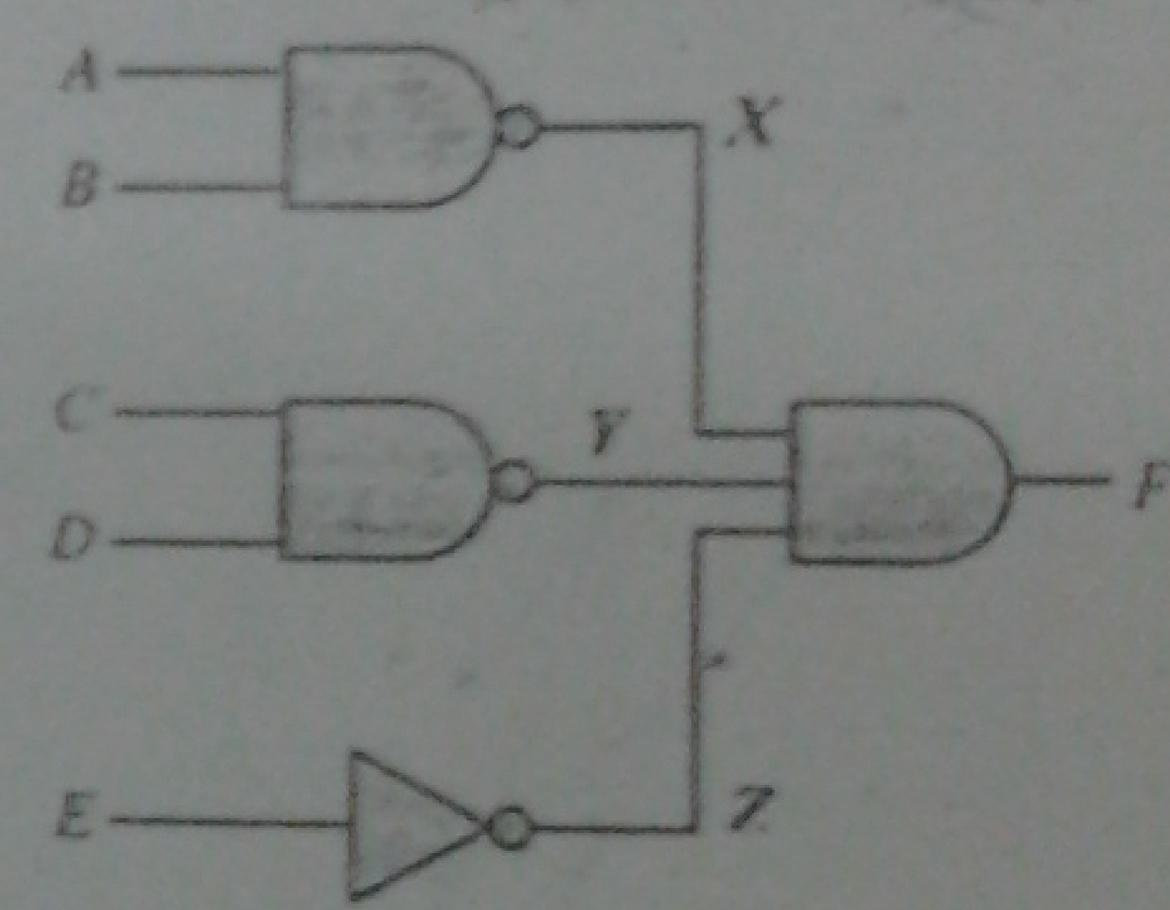
$= B(\underbrace{A+\overline{A}})$

$= B$

$AB+\overline{A}B$

A	B	$\overline{A}$	AB	$\overline{A}B$	
0	0	1	0	0	0
0	1	1	0	1	1
1	0	0	0	0	0
1	1	0	1	0	1

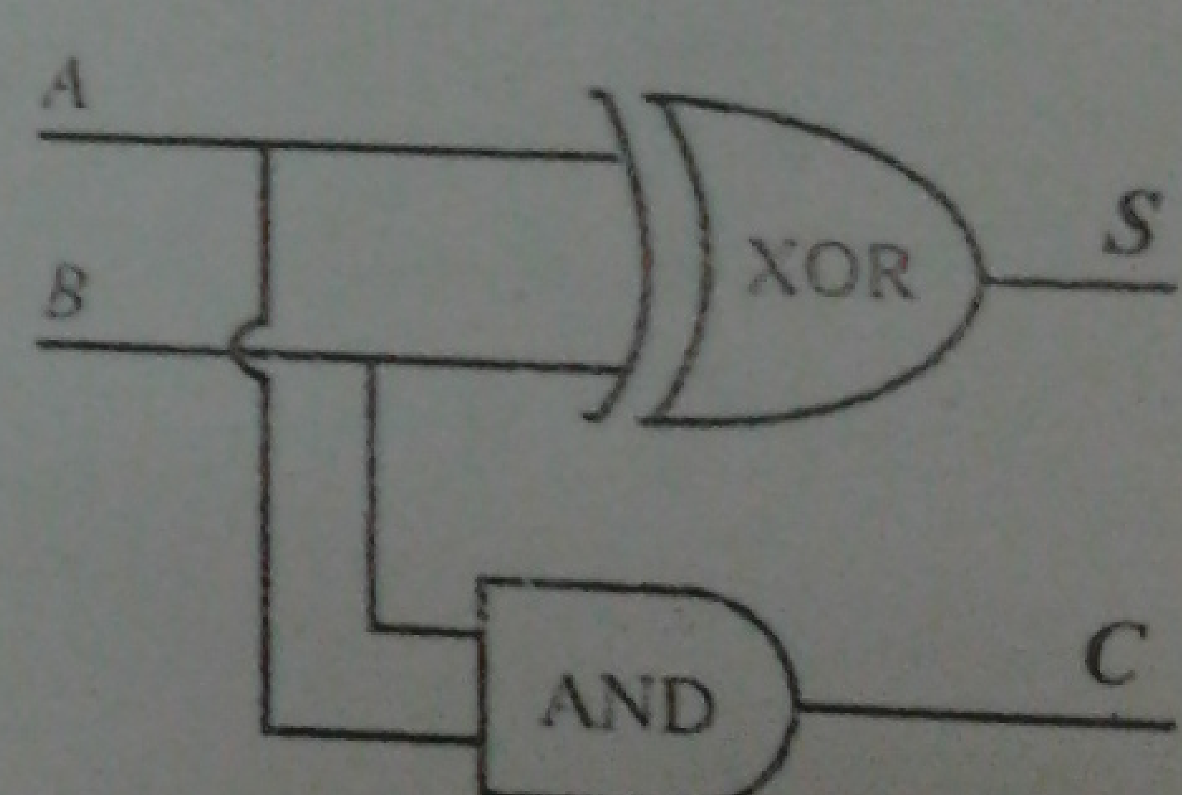
Q15-(3Pts) For the logic circuit shown. a- **Determine** the Boolean function describing the operation of the output *F*.
b- **Build** a truth table of this logic circuit, function by X, Y, Z.



a- $F=(\overline{A.B})\cdot(\overline{C\cdot D})\cdot(\overline{E})$ -

b-

Q16-(4Pts) For the logic circuit shown.
a- **Determine** the Boolean function describing the operation of the outputs *S* and *C*.
b- **Build** a truth table of this logic circuit.
c- Name the acts of this logic circuit.



a) $S = A \oplus B$

$C = A \cdot B$

a- $S = A \oplus B$

$C = AB$

b-

A	B	S	C
0	0	0	0
0	1	1	0
1	0	1	0
1	1	0	1

c- half-adder

Good Luck

Don't cry ☹, Just try ☺ ...

10/10