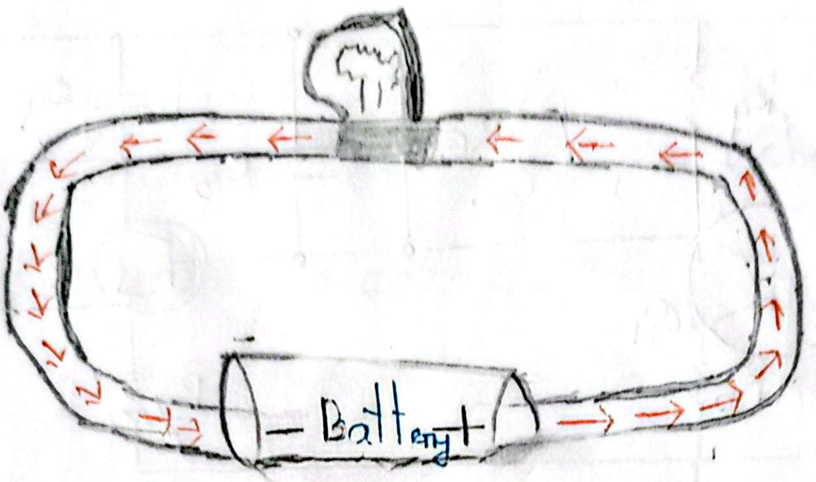
Dc Circuits — Basic Concepts.

Date :......................................



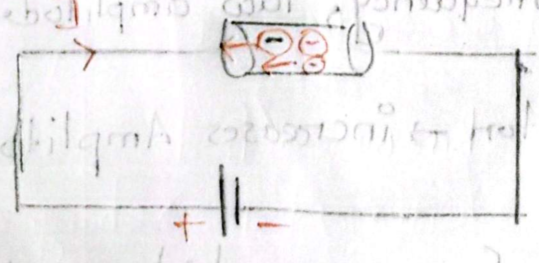
An electric circuit is a closed path throug which electric current flow.

interconnection of electrical element.

As like.

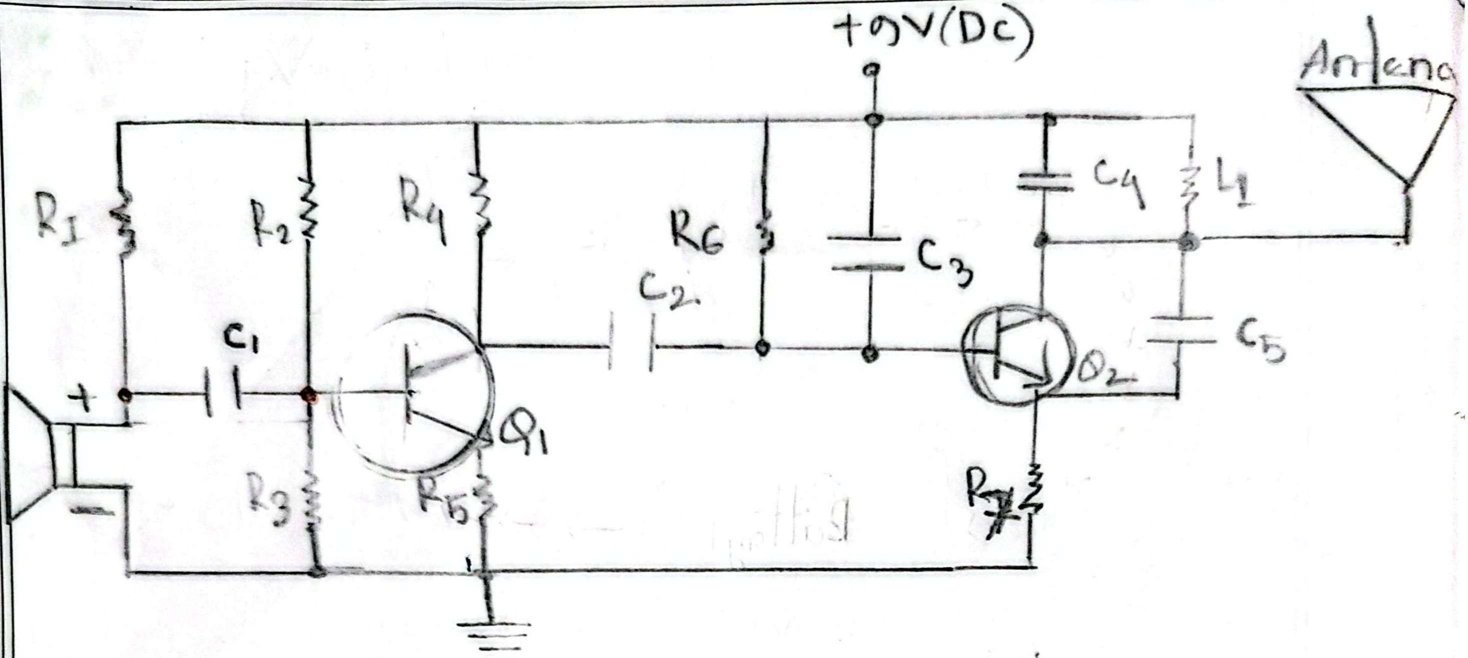
Battery + Wires + Switch + BulB → connected together

= Electric circuit.



Battery

Date :..................................



Electric circuit of radio transmitter.

Summary :-

Sound wave → (voice → has Amplitude + Frequency)

↓

Microphone → (converts Sound into voltage Signal Frequency unchanged) Amplitude Strong

↓

Electrical Signal → (Same frequency, low amplitude)

↓

Amplifier → (Transistor → increases Amplitude, F unchanged)

↓

Strong electrical Sig. → (Same Frequency high Amplitude

↓

Antena → (Transmits into air) The antena takes Strong Signal and sent to Space.)

Radio waves. →

Date :......................................

Problem 1 : How much charge is represent by 4600 electrons?

$Q = $ (number of electron $\times$ (charge of one electron)

$Q = 4600 \times 1.602 \times 10^{-19}$

$= 7.369 \times 10^{-16}$ c

problem 2 : calculate the amount of charge represented by six million protons?

$Q = N \times q$

$= (6 \times 10^{6}) \times (1.602 \times 10^{-19})$

$= 9.61 \times 10^{-13}$ c

Mid

problem 3 : The total charge entering a terminal is given by $q = 5t \sin 4\pi t$ mC.

calculate the current $t = 0.5s$,

Alternative : $q = 6t \sin 8\pi t$ mC.

$I = 2.5$

SHAKIB HOSSAN

Date :

Solution :

$$i = \frac{dq}{dt} = \frac{d}{dt}\left(5t \sin 4\pi t\right)$$

chain Rule
$f(t) = \sin(kt)$
$f'(t) = k \cos(kt)$

$\frac{d}{dt}[\sin(u)]$
$= \cos(u) \cdot \frac{du}{dt}$

$u = 4\pi t$

$u = 5t$
$u' = 5$

$v = \sin(4\pi t)$
$v' = \cos(4\pi t) \cdot \frac{d(4\pi t)}{dt}$
$v' = \cos(4\pi t) \cdot 4\pi$
$v' = 4\pi \cos(4\pi t)$

$$i(t) = \boxed{u'v + uv'} = 5 \cdot \sin(4\pi t) + 5t \cdot (4\pi \cos(4\pi t))$$

$$i(t) = 5 \cdot \sin(4\pi t) + 20\pi t \cos(4\pi t)$$

for $t = 0.5\,s$

$$i(0.5) = 5 \cdot \sin(4\pi \times 0.5) + 5 \times 0.5 \cdot (4\pi \cos(4\pi t))$$
$$= 5 \cdot \sin(4\pi \times 0.5) + 20\pi \times 0.5 \cos(4\pi \times 0.5)$$
$$= 5 \sin(2\pi) + 20\pi \times 0.5 \cos 2\pi$$
$$= 5 \times 0 + 20\pi \times 0.5 \times 1$$
$$= 10\pi \text{ mA}$$
$$\approx 31.42 \text{ mA}.$$

$4\pi \times 0.5 = 2\pi$
$\sin 2\pi = 0$
$\cos 2\pi = 1$

Date :..

$q(t) = 6t \sin(8\pi t)$

$i(t) = \frac{dq}{dt}$

$u = 6t, \quad u' = \frac{du}{dt} = 6,$

$v = \sin(8\pi t) ; \; v' = \frac{dv}{dt} = 8\pi \cos(8\pi t)$

$i(t) = u'v + uv' = 6 \times \sin(8\pi t) + 6t \times 8\pi \cos(8\pi t)$

$i(t) = 6\sin(8\pi t) + 48\pi t \cos(8\pi t)$

when $t = 2.5$

$i(2.5) = 6\sin(8\pi \times 2.5) + 48\pi \times 2.5 \cos(8\pi \times 2.5)$

$= 6 \sin \times 20\pi + 48\pi \times 2.5 \cos(20\pi)$

$= 6(0) + 48\pi(2.5) \times 1$

$= 120\pi \text{ mA} = 376.99 \text{ mA}$

IS in example 1. $q = (10 - 10e^{-2t}) mC$, $t = 1.0 s$.

$q(t) = (10 - 10e^{-2t}) \text{ mC}$

$i(t) = \frac{dq}{dt} \quad t = 1 s,$

$u = -10, \quad u' \frac{du}{dt} = 0$

$v = e^{-2t}, \quad \frac{dv}{dt} = -2e^{-2t}$

$i(t) = u'v + uv' = 0 + [0 \cdot e^{-2t} + (-10)(-2e^{-2t})]$

$= 20e^{-2t}$

$t = 1, \quad i(1) = 20e^{-2(1)} = 20e^{-2}$

$= 20 \times 0.1353 = \boxed{2.706} \text{ mA.}$

Date :.................................

Determine the total charge entering a terminal between $t=1s$, and $t_2=2s$ is the current passing the terminal is $i=(3t^2-t)A$.

$$i(t)=(3t^2-t)A$$

we know, $q=\int_{t_1}^{t_2} i(t)\,dt$

$$q=\int_1^2 (3t^2-t)\,dt$$

$$\int(3t^2-t)dt=\int 3t^2dt-\int t\,dt$$

$$=\left[(t^3)-\left(\frac{t^2}{2}\right)\right]_1^2$$

$$=\left(2^3-\frac{2^2}{2}\right)-\left(1^3-\frac{1^2}{2}\right)$$

$$=(8-2)+(1-0.5)$$

$$=6-0.5$$

$$=5.5\ C$$

$$\int t^n dt=\frac{t^{n+1}}{n+1}+c$$

$$\int k\,dt=k.t+c$$

REDMI NOTE 13
SHAKIB HOSSAN

CamScanner

The current flowing through an element is

$$i = \begin{cases} 4A & 0 < t < 1 \\ 4t^2 A & t > 1 \end{cases}$$

Calculate the charge entering the element from t =
t = 2s.

$$q = \int i(t)\,dt$$

$$q = \int_0^1 4\,dt + \int_1^2 4t^2\,dt$$

$$q = 4 \times \Big|_0^1 + 4\int_1^2 t^2\,dt$$

$$= 4 + 4\int_1^2 \frac{t^3}{3}$$

$$= 4 + 4\left[\frac{t^3}{3}\right]_1^2$$

$$= 4 + 4 \cdot \frac{2^3}{3} - \frac{1^3}{3}$$

$$= 4 + 4 \times \frac{8}{3} - \frac{1}{3}$$

$$= 4 + 4 \cdot \frac{7}{3}$$

$$= 4 + 9.333$$

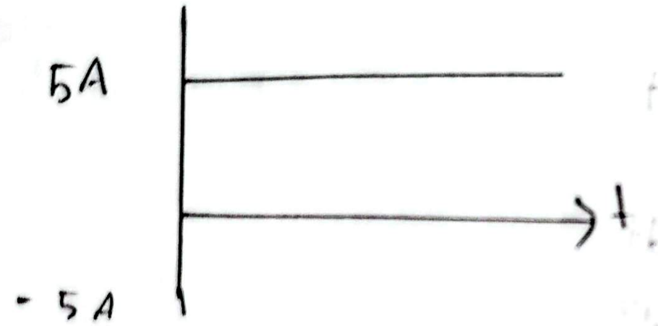
$$= 13.333\ C.$$

~~Voltage~~.

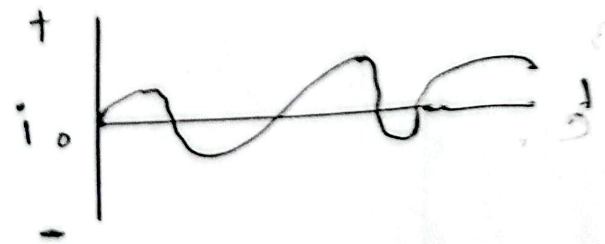
Date :......................................

Dc and ac current.

Direct current :- is a type of electric current th[at] flows in one direction only and doesn't chang[e] over time.



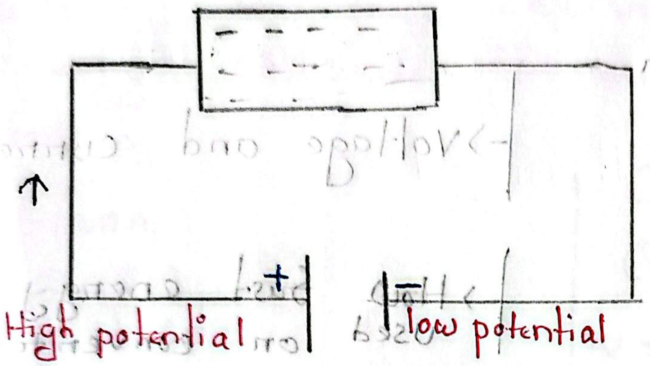
Ac current : is a type of current that chang[es] direction and Strength over time.



Voltage :

Date :.......................................

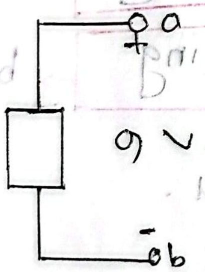
** Voltage and current usially constant ;

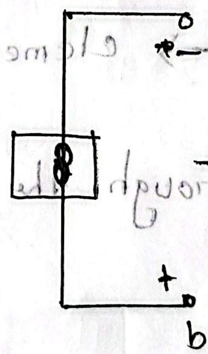


Voltage is the amount of energy required to move on coulomb of charge from one point to another.

1 volt = 1 joule/coulomb = 1 newton meter/ coulomb

$\boxed{V = \frac{w}{q}, \quad q = i \times t,}$ → w = energy of work, q = charge (coulomb) i = current





polarity of voltage.

Voltage Value	meaning	High potential	low potential
$V_{ab} = +5V$	a is higher than b	a (+)	b (−)
$V_{ab} = -5V$	a is lower than b	b (+)	b (−)

power of energy. Date :..

power: power measures how fast energy is used in a circuit.

instantaneous power

$p = v \times i$ → voltage and current

$P = \frac{W}{t}$ → How fast energy is used or converted.

$W = P \times t$ → Energy consumed.

2. Sign of power:

positive power → element is $\boxed{\text{absorbing}}$ → Resistor,

Negetive power → element is $\boxed{\text{Supplying}}$ → battery.

Current enter through the +,- terminal.

problem Solved.

Date :.....................................

1. An energy source forces a constant current of 2A for 10 s follow through a light bulb. If 2.3 kJ is given off in the form of light and heat energy. calculate the voltage drop across the bulb.

Given,

$I = 2A$

$T = 10 s$

$W = 2.3kJ = 2300 J$

$Q = I \cdot t$

$Q = 2 \times 10 = 20$ coulombs

$V = \frac{W}{Q}$

$V = \frac{2300}{20} = 115 V$

$V = 115$ Volts.

To move charge q from point a to point b requires -30 J. Find the voltage drop V_{ab} (a) q = 6C, (b) q = -3C.

Given,

$W = -30 J$

(a) q = 6C, (b) q = -3C

(a) $V = \frac{W}{q} = \frac{-30}{6} = -5 V$

(b) $q = -3C$

$V = \frac{W}{q} = \frac{-30}{-3} = 10 V$

REDMI NOTE 13
SHAKIB HOSSAN

CamScanner

Date :

Find the power delivered to an element at $t = 3$ ms if the current entering its positive terminal

$i = 5\cos 60\pi t$ A

and the voltage is (a) $= 3i$, (b) $v = 3\, di/dt$

(a)

We know, $p = v \times i$

$v = 3i$

$p = v \times i$
$= 3i^2$
$= 3(5\cos(60\pi t))^2$
$= 75\cos^2(60\pi t)$ W. Radian

$\rightarrow (ab)^2 = a^2 b^2$

$t = 0.003$

$p = 75\cos^2(60\pi \times 3 \times 10^{-3}) = 75\cos^2 0.18\pi = 53.48$ W.

(b) Given,

$i(t) = 5\cos(60\pi t)$

$\frac{d}{dt}[\cos(60\pi t)] = 5[-\sin(60\pi t) \times \frac{d}{dt}(60\pi t)]$

$= -5(60\pi)\sin(60\pi t)$

$\frac{di}{dt} = -300\pi \sin(60\pi t)$

$\frac{d}{dt}[\cos(x)] = -\sin(x)$

$f(t) = \sin(kt)$

$f'(t) = k\sin t$

Date :

$v = 3,$

$v = 3 \times (-300\pi \sin(60\pi t))$

$= -900\pi \sin(60\pi t)$

$t = 0.003,$

$v = -900\pi \times 0.5360 = -1515.0V$

$i = 4.2215A$

$p = v \times i$

$= (-1515.0) \times (4.2215)$

$= -6395.9W$

$i(t) = 5\cos(60\pi t)$

Radiant not degree

EE → wave / Ac form

Voltage Radian not

Sinusoidal degree

How much energy does a 100W electric bulb consume in two hours.

$w = pt = 100(w) \times 60(min \times h) \times 60(s/min)$

$= 720{,}000J = 720 kJ$

$w = pt = 100W \times 2h = 200Wh.$

Find the power delivered to the element in Example 1.5 at $t = 5$ ms if the current remain the same but the voltage is: (a) $v = 2i$,

(b) $v = \left(10 + 5\int_0^t i\,dt\right)V$

Date : ....

(a) we know $p = vi$,

$v = 2(i)$

$= 2(i)^2$

$= 2(5\cos(60\pi t))^2$

$= 50\cos^2(60\pi t)$

$t = 0.005$

$= 50\cos^2(60\pi \times 0.005)$

$= 17.27\ \omega$,

$\boxed{\text{Shift + Menu + 2 Ang + 2 Radian}}$

(b) $i(t) = 5\cos(60\pi t)$, $t = 0.005s$

$v(t) = 10 + 5.\int_0^T i\,dt$

$5\int_0^t i\,dt = 5\cos(60\pi t)\,dt$

$\int_0^{0.005} 5\cos(60\pi t)\,dt = 5.\frac{1}{60\pi}\sin(60\pi t)$

$= \frac{1}{12\pi}\sin(60\pi t)$

$5\int_0^t i\,dt = \frac{5}{12}\sin(60\pi t)$

$= \frac{5}{12} \times \boxed{\sin(60\pi \times 0.005)} =$

Calculation Radian

Current $i = 5\cos(60\pi t)$ Rad

$= 2.133$

$v = \cancel{10 + 2.133} = 10 +$

Date :...

A Stove element draws 15A when connected to 240-V line. How long does it takes to consum 180 kJ

$$t = \frac{180{,}00}{240 \times 15}$$

$$240 \times 15 = 3600$$

$$= \frac{18{,}00}{3600} = 50\,s$$

$P = VI$

$W = P \times t$

$t = \frac{W}{P} = \frac{W}{VI}$

All tricks

Circuit Elements

Date :..

Two Types

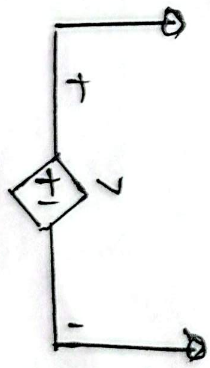
passive

They cannot produce energy only store energy.

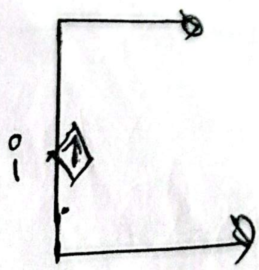
active

produce and Supply energy
Generator Batt

Ideal Independant:- This is a Special active elem
It gives final voltage or current that depend on other part circuit. provieds specified constant voltage or current.



dependent voltage



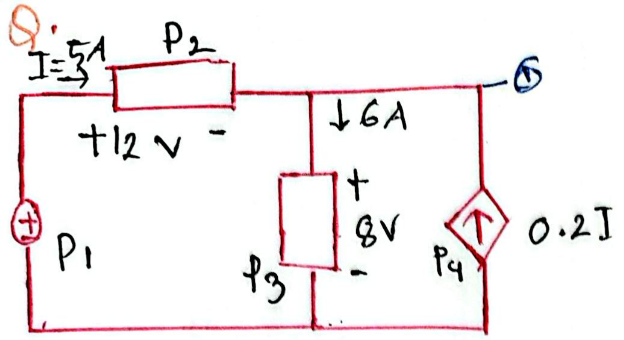
dependent current Source.

→ Depends on Another voltage or current.

important page

Date :...............................

Q.



Q calculate the power Suppl on absorbed by each element

Solution:

$P_1 = 20(-5) = -100\,w$ (supplied)

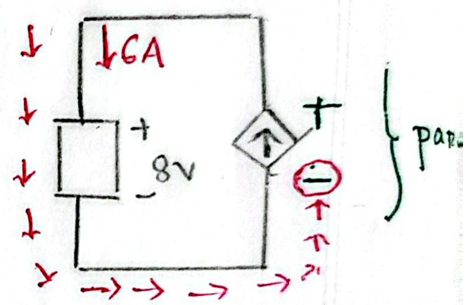
$P_2 = 12 \times 5 = 60\,w$ (Absorbed)

$P_3 = 8 \times 6 = 48\,w$ (Absorbed)

$P_4 = 8 \times (-1) = -8\,w$ supplied.

$\therefore P_1 + P_2 + P_3 + P_4 = -100 + 60 + 48 - 8$

$= 0$



① voltage is always measured between two points

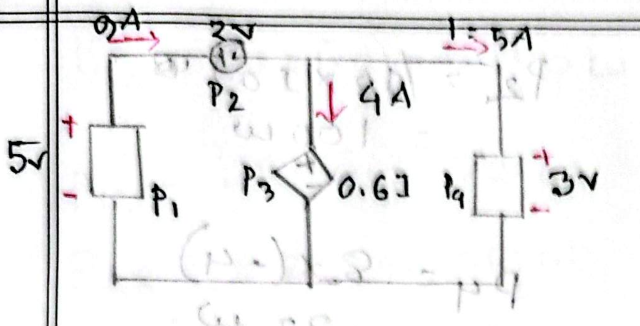
② Two element conn Same pain of terminal the will have Same Voltage.

Total power Supplied = Total power absorbed.

(+Pabsorbed) + (-psupplied) = 0

Nothing is lost on created - it only moves from one element to another.

Date :...



* Compute the power absorbed or Supplied by each component of the circuit

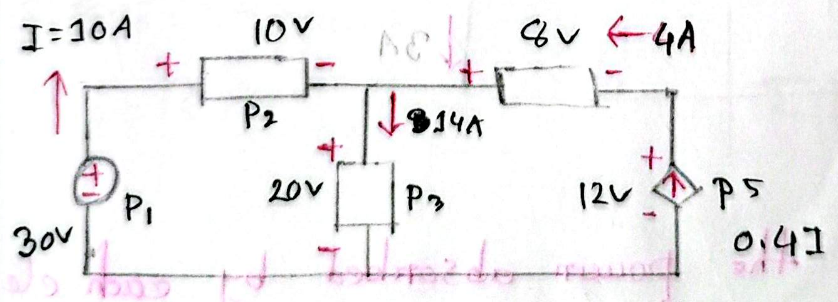
$P_1 = 5 \times (-9) = -45W$

$P_2 = 2 \times 9 = +18W$

$P_3 = 3 \times 4 = 12W$

$P_4 = 3 \times 5 = 15W$

1.18:



Find the power absorbed by each of the elements

Date :.......................................

Solution:-

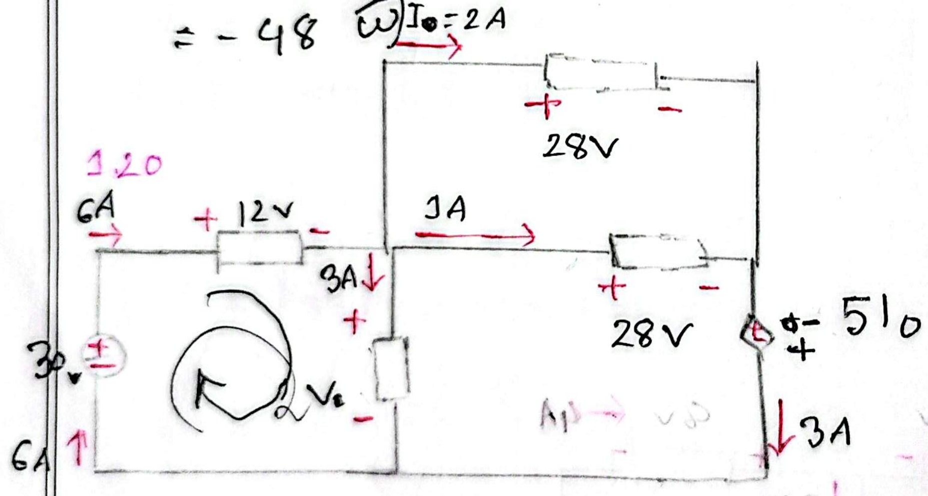
$P_1 = 30 \times (-10)\,W$
$= 300W$

$P_2 = (10 \times I_0)\,W$
$= 100\,W$

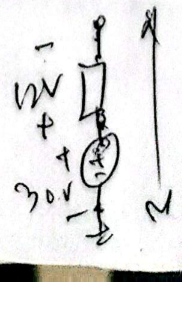
$P_3 = (14 \times 20)$
$= 280\,W$

$P_4 = 8 \times (-4)$
$= -32\,W$

$P_5 = (0.4I) \times 12$
$= 12 \times (0.4 \times (-10))$
$= 12 \times (-4)$
$= -48\,W$



Find V_0 and the power absorbed by each element in the current? of fig 1.31



$+30V - 12V$
$= 18V$

Date :..

$P_{30} = 30 \times (-6) = -180\,W$

$P_{12} = 12 \times 6 = 72\,W$

$P_{28} = 28 \times 1 = 28\,W$

$P_{28} = 28 \times 2 = 56\,W$

$P_{10} = 10 \times (-3) = -30\,W$

$\boxed{V_x = k \times I_{control}}$

V_x = dependent voltage source voltage

$I_{control}$ = the controlling current (from another branch

k = proportionally constant.

$V = 5I_0$ $V = 5 \times 2 = 10V$	$k = 5\Omega$ $I_0 = 2A$

we know, power blance

$= P_1 + P_2 + P_3 + P_4 + P_5 + P_6 + P_0 = 0$

$\Rightarrow -180 + 72 + \;\; + 56 + 28 - 30 = 0.$

$\Rightarrow V_0 = 210 - 156$

$\Rightarrow P_0 = 54$

$= V_0 = 18V$

$P_0 = V_0 I_0$

$V_0 = \frac{P_0}{I_0}$

$\Sigma P = 0$

REDMI NOTE 13
SHAKIB HOSSAN

CamScanner

Ohms law

Date :...

Resistance: opposes the flow of electric current.

$$R = \rho \frac{L}{A}$$

L — length
A — Area
ρ — Resistivity

ohms law: Voltage is directly proportional to current

$$V = iR$$

R — Resistance
i — Current.

$$R = \frac{V}{i}$$

$1\Omega = 1\ V/A$.

conductance G: How easily current flow through a material

R is low $\Longrightarrow$ high conductance
R is high $\longrightarrow$ low conductance

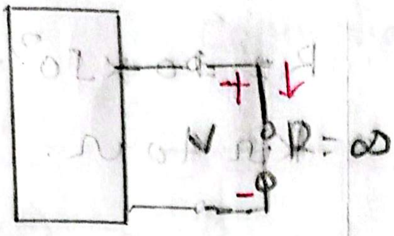
$$G = \frac{1}{R} \quad \text{mho } \mho$$

$$i = GV$$

$$P = Vi = i^2R = \frac{V^2}{R}$$

$$P = Vi = V^2G = \frac{i^2}{G}$$

Date :..

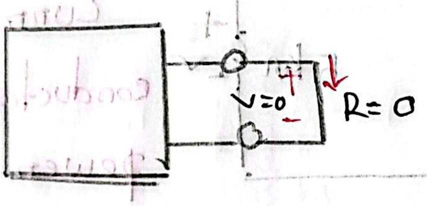


* Higher potential to a lower potential = $V = iR$

* low potential to a higher potential $V = -iR$.

$i = \lim_{R \to \infty} \frac{V}{R} = 0$

Open circuit: Resistance approaching infinity



circuit + very low to zero, almost no voltage drop.

current: $I = \frac{V}{R} \to$ extremly large.

Short circuit: Resistance approaching zero.

2A at 120 R = ?

$R = \frac{V}{I} = \frac{120}{2} = 60\,\Omega$.

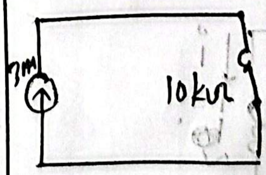
2.1:

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

$= \frac{110}{15}$

$I = 7.333$

2.2



For the circuit 2.9 Calculate the voltage V the conductance G and the power P. ?

REDMI NOTE 13
SHAKIB HOSSAN

CamScanner

Date :..................................

Voltage

$V = IR$

$= 3 \times 10$

$= 30V$

conductance

$G = \frac{1}{R}$

$G = \frac{1}{10^4}$

$= 100mS$

$R = 10 \times 10^3 = 10^4 \Omega$

$k\Omega$ to Ω.

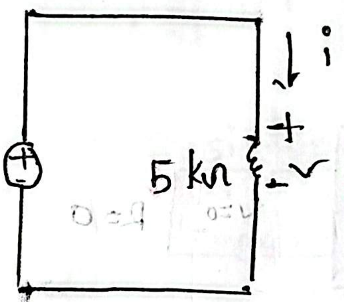
power

$P = V \times I$

$= 30 \times 3 \times 10^{-3}$

$= 90 \times 10^{-3} W$

$\therefore P = 90 mW$



current?

conductance G?

power p?

Solve :

$i = \frac{V}{R} = \frac{30}{5 \times 10^3} = 6 mA$

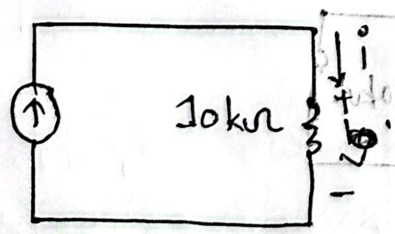
$G = \frac{1}{R} = \frac{1}{5 \times 10^3} = 0.2 mS$

$P = Vi = 30(6 \times 10^{-3}) = 180 mW$

$P = i^2 R = (6 \times 10^{-3})^2 5 \times 10^3 = 180 mW$

$P = V^2 G = (30^2) 0.2 \times 10^{-3} = 180 mW$

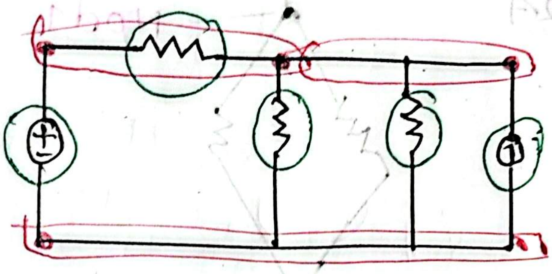
2.2



Voltage? conductance? power p?

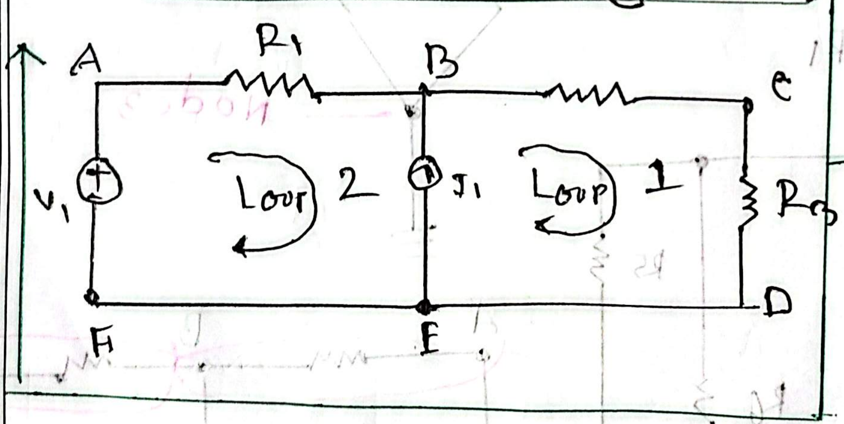
Date :....................................

Branches : A Branch represent a Single element such as voltage Sources, resistance.

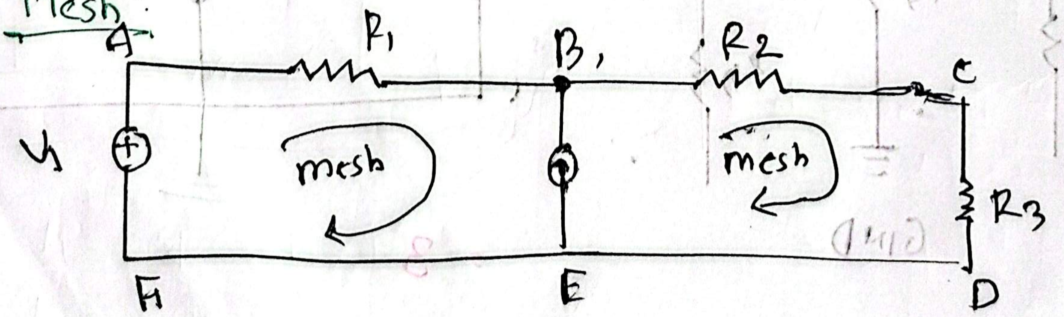


5 branch
3 node.

Loop : a loop is any closed path in a circuit



Mesh :



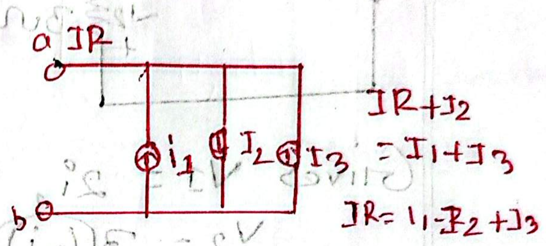
A mesh is is a loop do not contain any other loops within it.

Kirchof voltage law (kvl)
Kirchof current law (kcl)

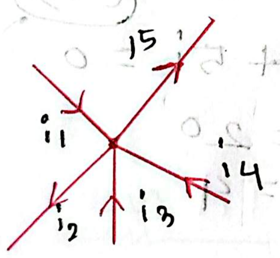
Date :..

kcl = kirchof current law states that algebric sum of current entering node zero

$\Sigma I = 0$



Entering → = + positive
leaving → = − negative



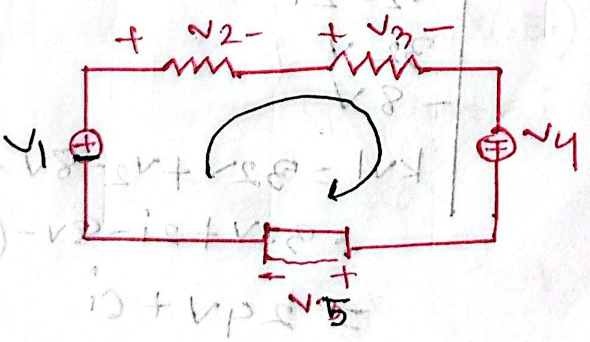
$= i_1 + (-i_2) + i_3 + i_4 + (-i_5) = 0$

$i_1 + i_3 + i_4 = i_2 + i_5$

KVL: closed path all voltage sum = 0

$\Sigma V = 0$

voltage drop = Voltage gain

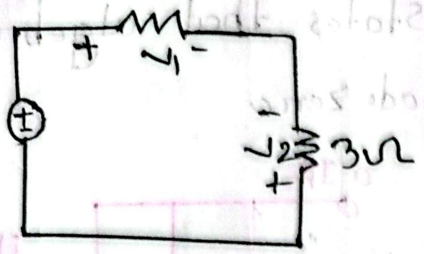


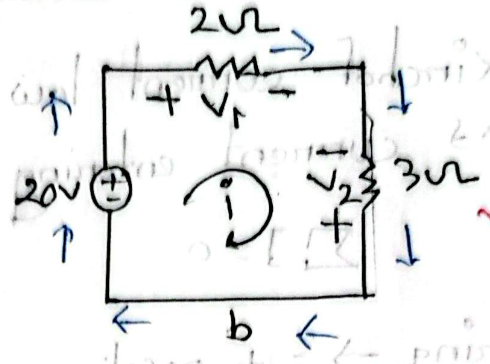
$-V_1 + V_2 + V_3 - V_4 + V_5 = 0$

$V_2 + V_3 + V_5 = V_1 + V_4$.

Find voltage gives current

2.5.





Find Voltage v_1 and v_2.

Gives $v_1 = 2i$,

$v_2 = 3(-i)$ — look

$= -3i$

~~v_s~~ 20V

KVL $= -20 + v_1 - v_2 = 0$

$= -20 + 2i - (-3i) = 0$ — carefully.

$= -20 + 5i = 0$

$\Rightarrow 5i = 20$

$= i = 4$

we know

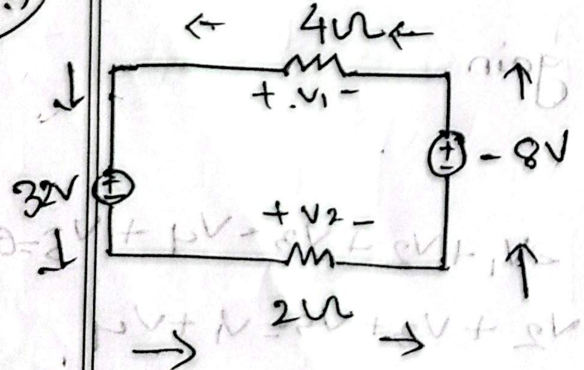
~~I=V/R~~ $V = IR$

$v_1 = 8$

$v_2 = -3 \times 4$

$= -12$

2.5.



$v_1 = -4i$

$v_2 = 2i$

32 V

-8 V

KVL $= 32V + v_2 - 8V - v_1$

$= 32V + 2i - 8V - (-4i)$

$= 24V + 6i$

$\Rightarrow 6i = -24$

$= 6i = \frac{-24}{6}$

$i = -4$

$v_1 = -4 \times -4 = 16$

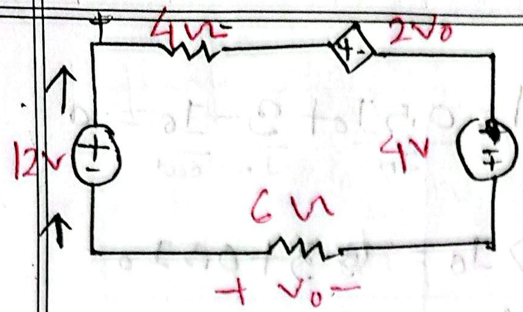
$v_2 = -4 \times 2 = -8$

$$\boxed{\begin{gathered}32V + (-8) - 8V - 16 \\ 32 - 32 = 0\end{gathered}}$$

proved

Ans correct.

Date :..............................



$KVL = -12V + 4i + 2V_0 - 4 + 6i$

$= -16V + 10i + 2V_0 = 16$

$= 10i + 2(-6i) = 16$

$= -2i = 16$

$= i = -8A$

ohm's law

$V = iR$

∴ lost Resistor

$V_0 = (-i)6$

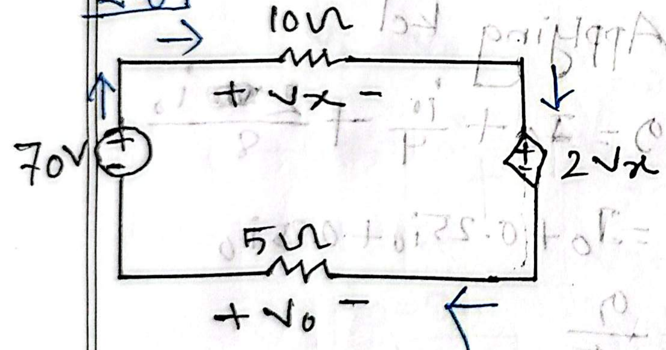
$= -6i$

$V_1 = 4i$

$V_2 = -6i$

$V_{0H} = -6(-8) = 48V$

2.61



$V_x = 10i$

$V_0 = 5i$

$\Rightarrow -70V + 10i + 2V_x - (-5i) = 0$

$\Rightarrow -70V + 10i + (2 \times 10) + 5i = 0$

$\Rightarrow$ - 35i = 70V

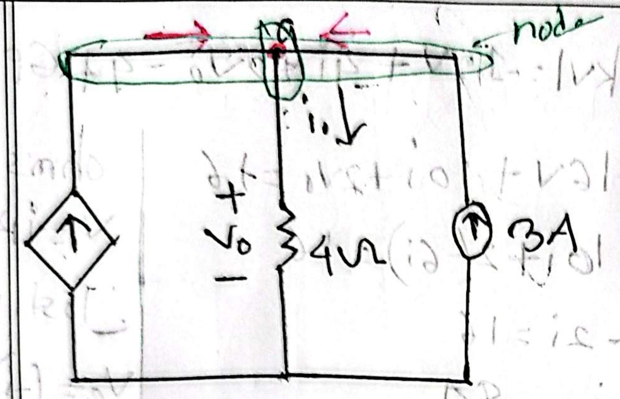
$i = \frac{70}{35} = 2A$

$V_x = 10 \times 2 = 20V$

$V_0 = -5 \times 2 = -10V$

2.7

Date :..



$KCL = \underset{In}{0.5I_o} + \underset{In}{3} - \underset{Out}{I_o} = 0$

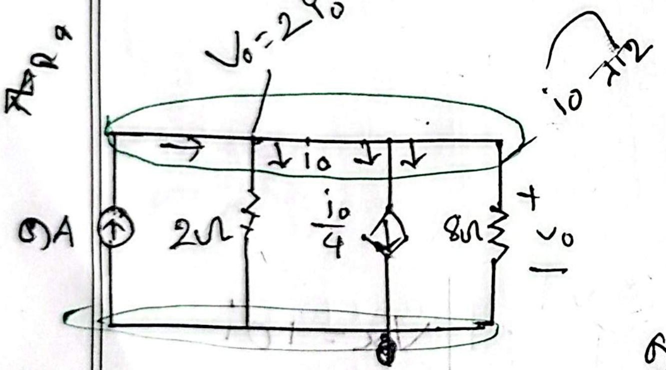
$\Rightarrow I_o = 3 + 0.5I_o$

$i_o - 0.5I_o = 3$

$i_o = \frac{3}{0.5} = 6A$

$V_o = 4 \times 6 = 24V$

Prob 9



Applying KCL

$9 = I_o + \frac{i_o}{4} + \frac{2 i_o}{8}$

$9 = I_o + 0.25i_o + 0.25i_o$

$i_o = \frac{9}{1.5}$

$= 6A$

$V_o = 2i_o = 2 \times 6$

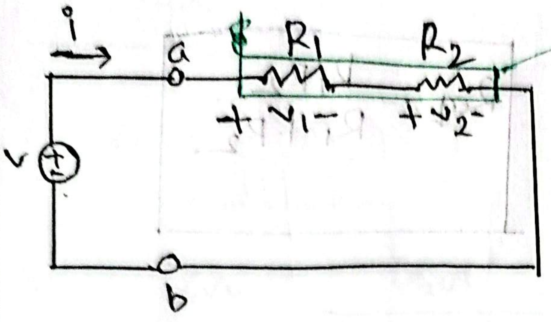
$= 12V$ Ans

$V_o = i_o R \rightarrow i_o$

$= i_o \times 2$

Date :

Series Resistors and Voltage



Total Resistance

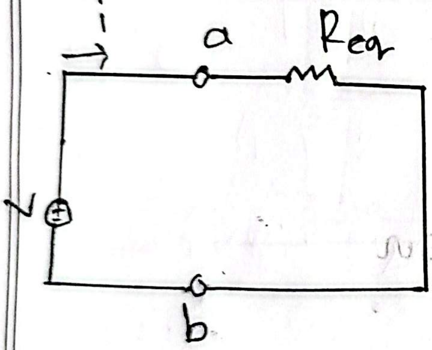
$$R_{eq} = R_1 + R_2 + \dots + R_N = \sum_{n=1}^{N} R_n$$

law

$$v_1 = \frac{R_1}{R_1 + R_2} v, \quad v_2 = \frac{R_2}{R_1 + R_2} v$$

Total Resistance　　Total Resistance

True . ok



$v_1 = iR_1$　$v_2 = iR_2$　$P = vi$

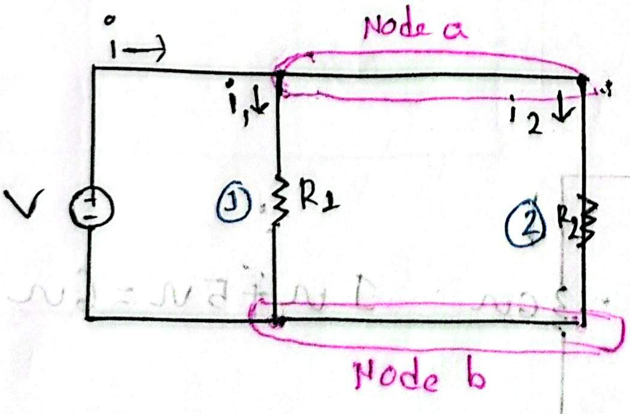
Find Req for the pair

True checker

(i) $v = v_1 + v_2$　　$i_1 = \frac{v_1}{R_1}$, $i_2 = \frac{v_2}{R_2}$

(ii) $\frac{v_1}{v_2} = \frac{R_1}{R_2}$　　$i_1 = i_2$

parallel Resistor and current Division



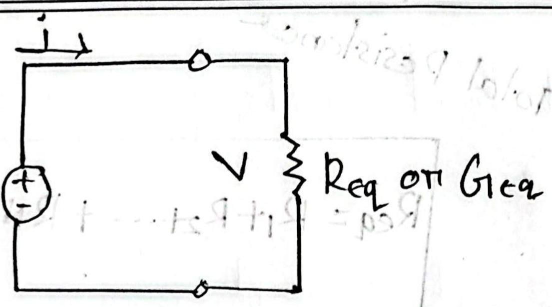
$$\frac{1}{R_{eq}} = \frac{1}{R_1} + \frac{1}{R_2} + \dots + \frac{1}{R_N}$$

$$i_1 = \frac{R_2 i}{R_1 + R_2}, \quad i_2 = \frac{R_1 i}{R_1 + R_2}$$

$i_1 = R_2$　　$i_2 = R_1$

$1 = 2$　　$2 = 1$

Date :..



$$R_{eq} = \frac{R_1 R_2}{R_1 + R_2}$$

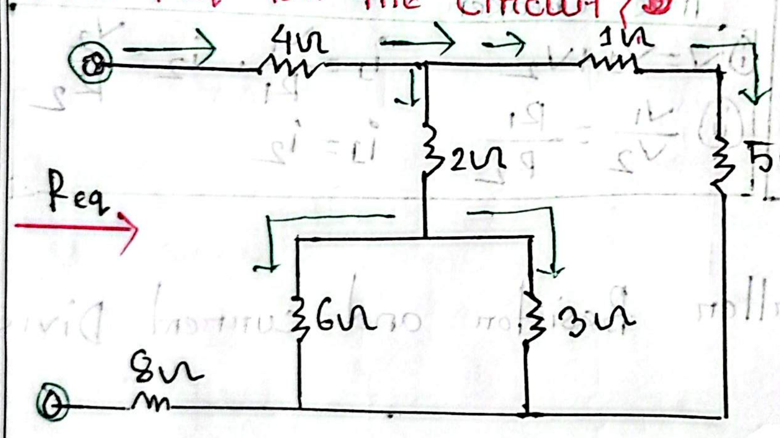
$i_1 + i_2 = i$?

$i_1 R_1 = i_2 R_2$?

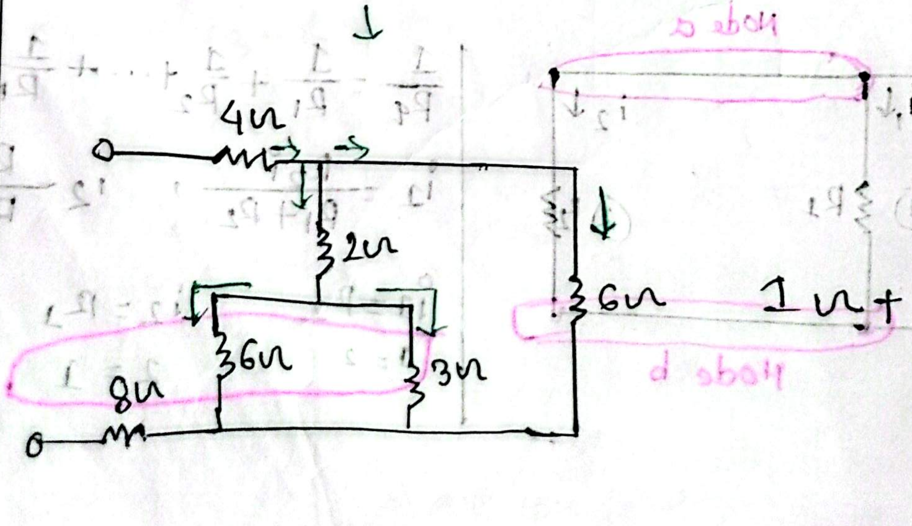
$i = \frac{V}{R_{eq}}$?

→ True. ok.

Find Req for the circuit?

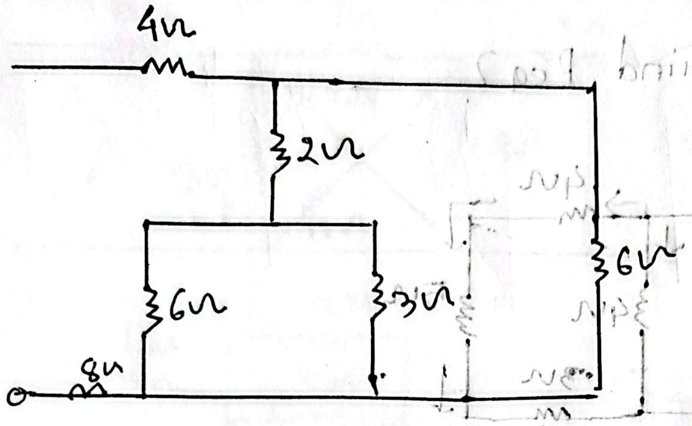


↓

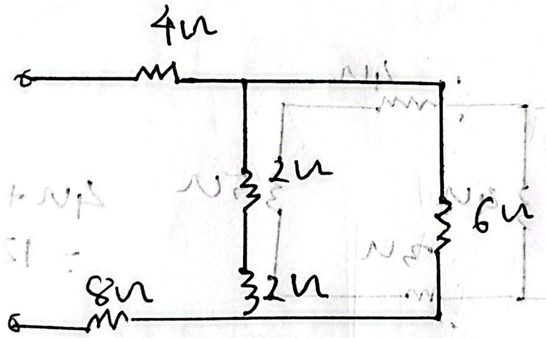


$1\Omega + 5\Omega = 6\Omega$

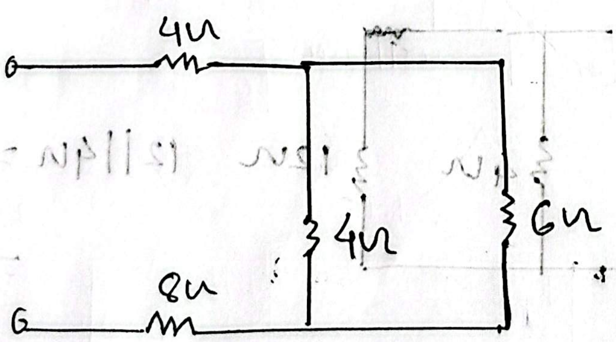
Date :......................................



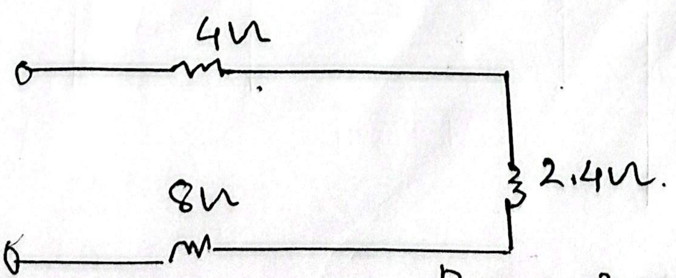
$3\Omega + 3\Omega = 6\Omega$



$6\Omega \parallel 3\Omega = \frac{6\times3}{6+3} = \frac{18}{9} = 2\Omega$



$= 2\Omega + 2\Omega = 4\Omega$



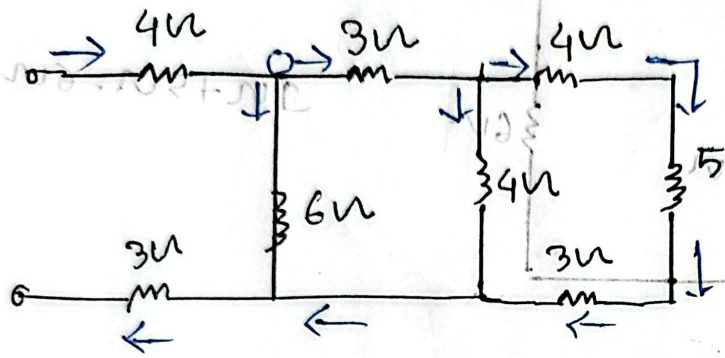
$4\Omega \parallel 6\Omega = \frac{4\times6}{4+6} = 2.4\Omega$

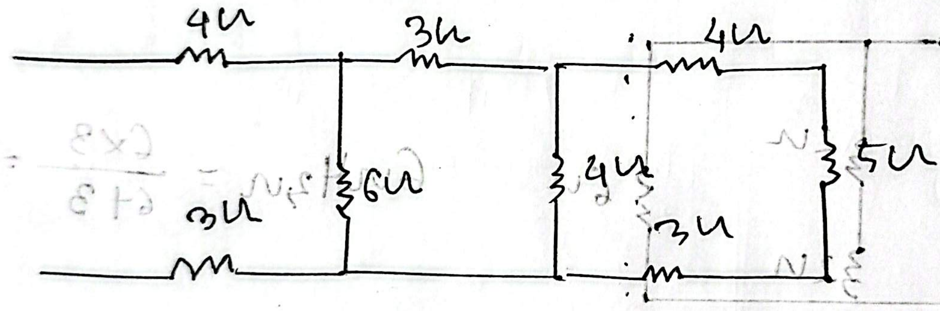
$R_{eq} = 4\Omega + 2.4\Omega + 8\Omega = 14.4\Omega$

Date :....................................

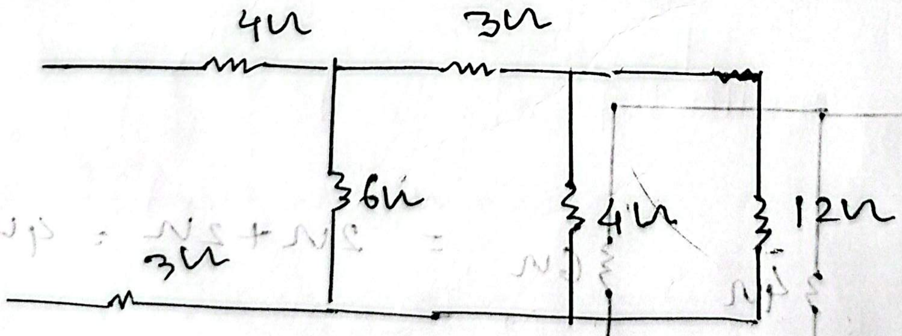
2.9:

practice problem Find Req?





$4\Omega + 5\Omega + 3\Omega$
$= 12\Omega$



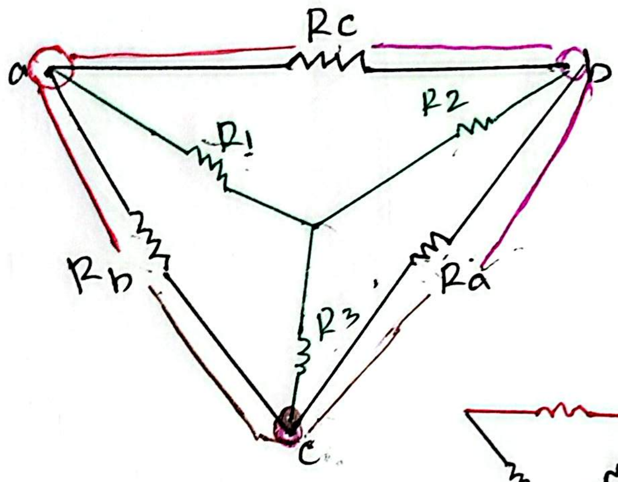
$$12 \| 4\Omega = \frac{12 \times 4}{12+4} = \frac{48}{16} = 3$$

REDMI NOTE 13
SHAKIB HOSSAN

Date :

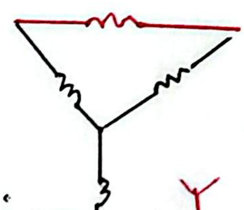
1 Delta to ~~wave~~ wye conversion

connected



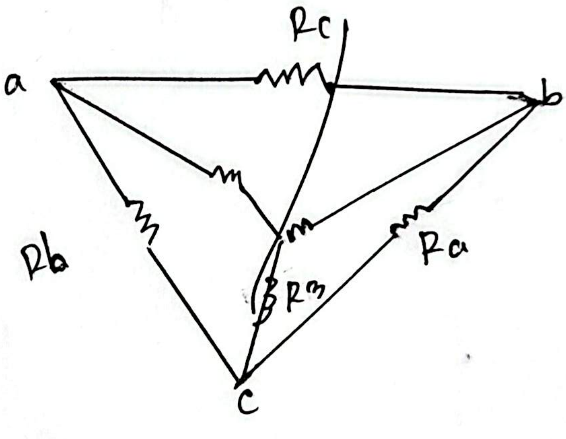
$$R_1 = \frac{R_b R_c}{R_a + R_b + R_c}$$

$$R_2 = \frac{R_a R_c}{R_a + R_b + R_c}$$



Wye to Delta conversion

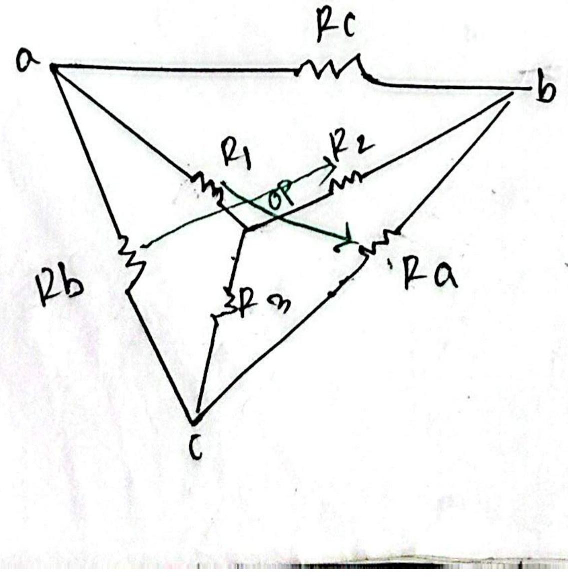
Y to Delta see carefully



opposite line

like $R_b \rightarrow R_1\ R_3$ connected

but opposite = R_2.

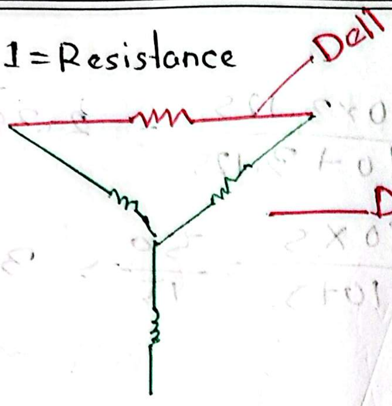


$$R_a = \frac{R_1R_2 + R_2R_3 + R_3R_1}{R_1}$$

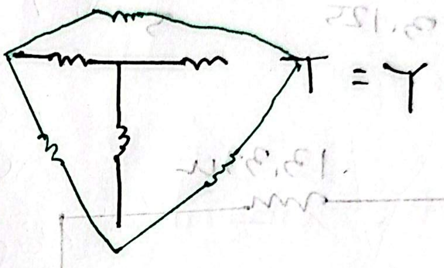
$$R_b = \frac{R_1R_2 + R_2R_3 + R_3R_1}{R_2}$$

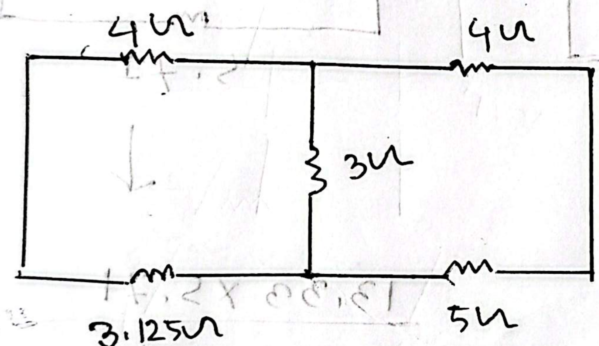
Date :......................................

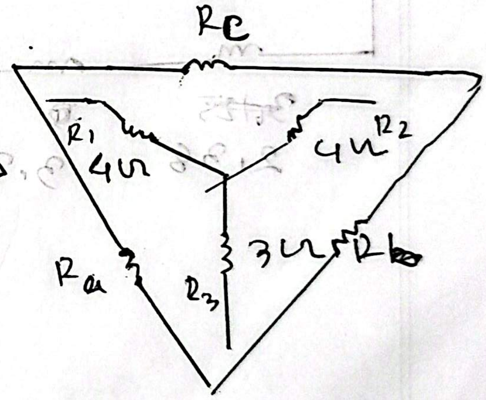
1 = Resistance



Dell to Y Short tricks.







$$R_a = \frac{(4\times4)+(4\times3)+(3\times4)}{3} = \frac{40}{3}\,\Omega = 13.333$$

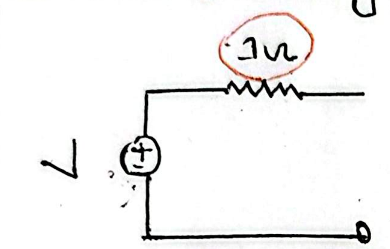
$$R_b = \frac{(4\times4)+(4\times3)+(3\times4)}{4} = \frac{40}{4}\,\Omega = 10\,\Omega$$

$$R_c = \frac{40}{4} = 10\,\Omega$$

Transformation Source

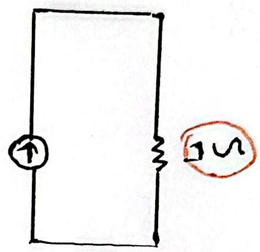
Voltage to current

Condition :- Voltage এর সাথে Series এ থাকবে ।



to

$I_S = \frac{V_S}{R} =$



1Ω - same

রেজিস্টর Same থাকবে parallel হবে কারেন্ট সোর্স এ ।

Current Source to Voltage

Condition :- কারেন্ট সোর্স সাথে রেজিস্টর parallel

$V_S = IR$,

$\boxed{\ominus\downarrow \quad \oplus\uparrow}$

$V_1 = \frac{R_1}{R_1+R_2} \times V$

V_o, I_o Divider Rules ,

$I_1 = \frac{R_2}{R_1+R_2} \times I$ — Total current

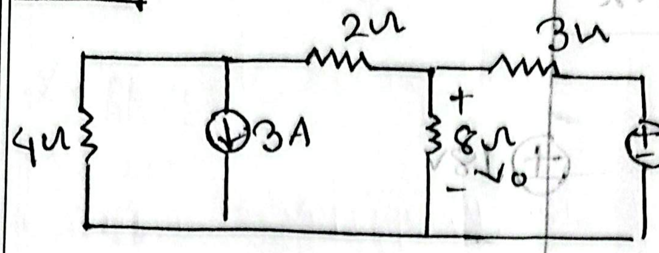
$V_o = I_o R$

$I_o =$

◇ -> Dependent = loop .

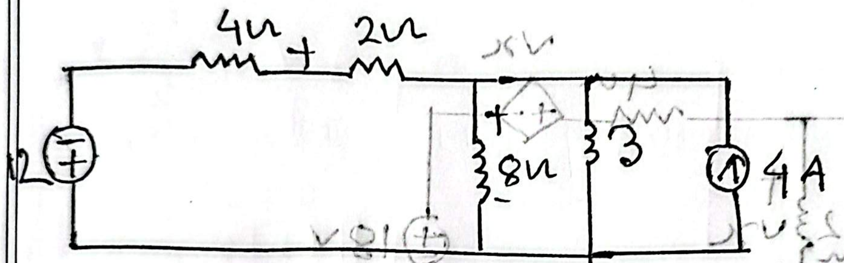
Date :

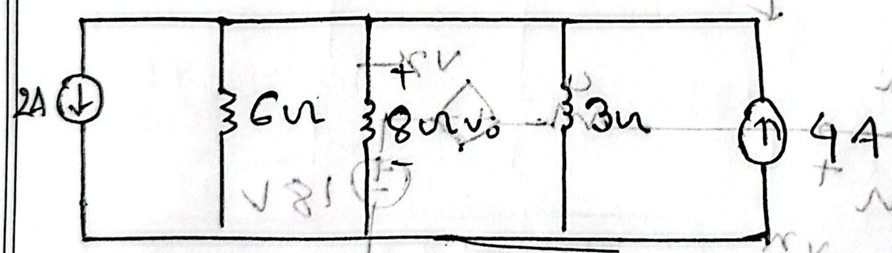
4.6



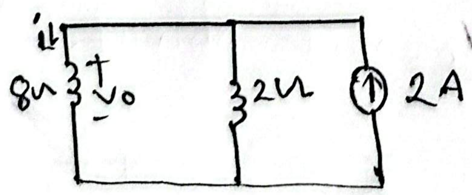
find V_o?

F.P





$6 \| 3 = 2$, $4 - 2 = 2$



$$i = \frac{2}{2+8}(2) = 0.4A$$

$$V_o = 8i = 8(0.4) = 3.2V$$

Capacitor

$\boxed{i(t) = C\frac{d}{dt}\, v(t)}$ কারেন্ট দেখা যায় — কারেন্ট follow opposite থেকে শুরু

ক্যাপাসিটর voltage এর

$v = \boxed{\frac{1}{C}\int_{t_0}^{t} i(\tau)\, d(\tau) + v_{t_0}}$ = Voltage

$\boxed{P(t) = Cv(t)\frac{d}{dt}\, v(t)}$

$\boxed{w(t) = \frac{1}{2}Cv^2(t) - \frac{1}{2}Cv^2(-\infty)}$

$$V_1 = \frac{\text{total voltage} \times \frac{1}{C_1}}{\frac{1}{C_1} + \frac{1}{C_2} + \cdots}$$

$V_1 = \frac{q}{C_1}$

$q_1 = C_{eq} V$

$C_{eq} = C_1 + C_2 + C_3 + \cdots + C_N$

$\frac{1}{C_{eq}} = \frac{1}{C_1} + \frac{1}{C_2} + \frac{1}{C_3} \cdots + \frac{1}{C_N}$

capacitor $\longleftrightarrow$ Resistance

$\mu F = 10^{-3}$

Date :

Inductor.

$\boxed{v(t) = L_{eq}\frac{di}{dt}(t)}$ → Voltage কেমন হয় ~~Capacitor~~

$\boxed{\frac{1}{L}\int_{t_0}^{t} v(\tau)\,d\tau + i(t_0)}$ — কারেন্ট এর সমান

$\boxed{p(t) = Li(t)\frac{d}{dt}i(t)}$

$\boxed{w(t) = \frac{1}{2}Li^2(t) - \frac{1}{2}Li^2}$

$$i_L = \frac{\text{অপর ব্রাঞ্চ} \times \text{Total}}{\text{দুই ব্রাঞ্চের Resistance}}$$

$\frac{d}{dt}(e^{at})$

$\Rightarrow ae^{at}$.

→ Remember

3/4: Supperposition theorem, Date: ....

$$VDR = \frac{\text{Main Resistance}}{\text{Total } R} \times \text{Total volt}$$

(in the denominator, ~~Main R~~ + opposite R is corrected to Total R)

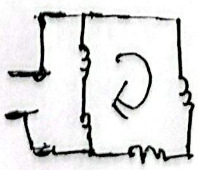
$$CDR = \frac{\text{opposite Resistance}}{\text{Total Main } R + \text{opposite } R} \times \text{Total current},$$

Depandent (+-) | +3, Mesh analysis, otherwise CDR + VDR

$I = \frac{V}{R}$, $V = IR$,

$\boxed{\text{যদি কারেন্ট দেওয়া থাকে তবে } i_1 \text{ সমীকরণে নিব না} \rightarrow 5A,}$ → i_1, i_2, i_3 না নিয়ে সরাসরি কারেন্ট হিসাবে ধরব।

$\boxed{i.\ 2(i_1 - i_2) \text{ এইরকম formation open circuit হবে না}}$ → লুপে তার নিজস্ব current হবে। দুই loop adjust হবে না।



$3i_1$ ✓

$3(i_1 - i_2)$ ✗

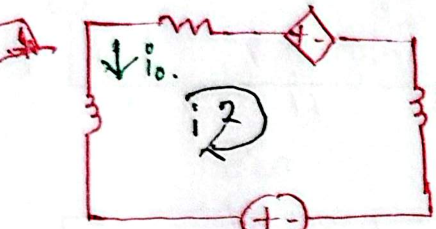
Superposition ⇒ turn of I by I, all

Just Independent Source,

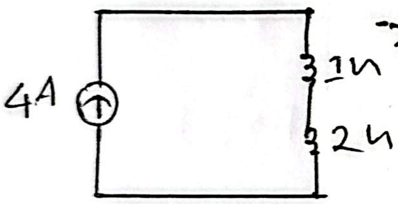
Important,

Date :..

Direction খেয়াল করবে $\uparrow \circlearrowright = -$,
Current Source, $\uparrow \circlearrowleft = +$,



→ যদি কোন loop মধ্যে i_0 দেওয়া থাকে v_x,
তাহলে i_0 = সেই loop like $i_0 = i_2$,



যখন কোনো সোর্স থাকবে তখন KCl
দিয়ে বের করবে i_0 সহজ।

সরাসরি সার্কিট সলভ করে করা যাবে. i_1, i_2, i_3

$\boxed{\text{Depandent Source থাকবে না CDR, VDR হবে না ও}}$ → অন্য Source থাকবে।