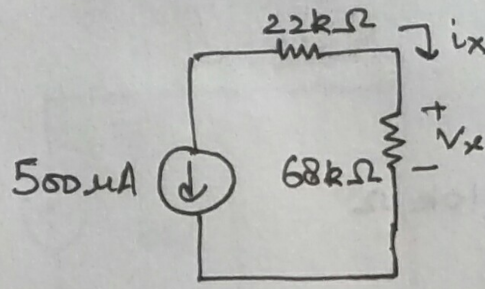
2.25)



$i_x = -500\ \mu A$

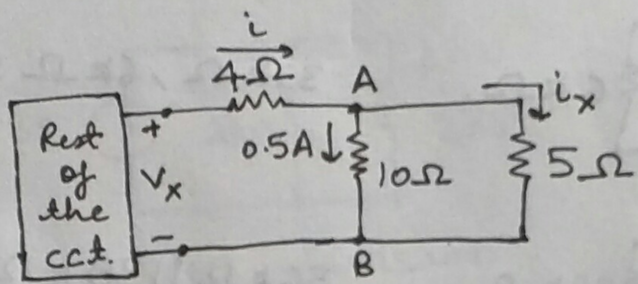
$V_x = i_x \times 68\ k\Omega$

$= -500 \times 10^{-6} \times 68 \times 10^{3}$

$= -34000 \times 10^{-3}$

$= -34V$

2.29)



KCL at A : $i - 0.5 - i_x = 0$

$\Rightarrow i = 0.5 + i_x$

$V_{10\Omega} = V_{5\Omega}$ (KVL)

$\Rightarrow 10 \times 0.5 = 5 \times i_x.$

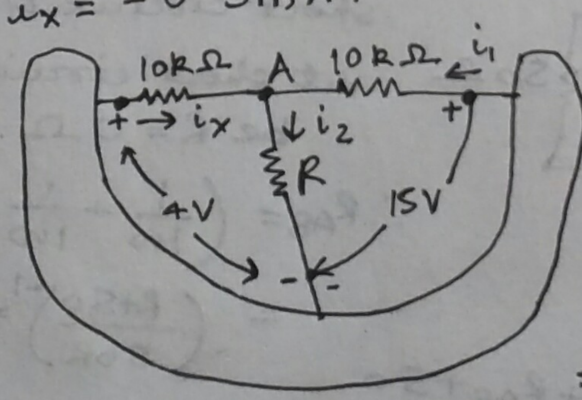
$\Rightarrow i_x = 1\ A$

$\therefore i = 1.5\ A$

$V_x = V_{4\Omega} + V_{10\Omega} = 4 \times 1.5 + 10 \times 0.5$

$\Rightarrow V_x = 11\ V$

2.33) $i_x = -0.5 mA.$



KCL at A:

$i_x + i_1 - i_2 = 0.$

$4 = 10 \times 10^{3} \times (-0.5) \times 10^{-3} + i_2 \times R.$

$\Rightarrow 4 = -5 + i_2 R. \quad -(i)$

$-10 \times 10^{3} \times i_1 + 15 - i_2 R = 0$

$\Rightarrow 15 = 10 \times 10^{3} i_1 + i_2 R.$

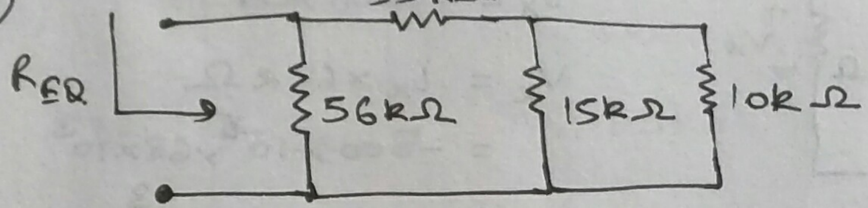
$\because i_2 R = 9 \Rightarrow 15 = 10^{4} i_1 + 9.$

$\Rightarrow i_1 = 6 \times 10^{-4} = 0.6 mA$

$i_2 = i_x + i_1 = -0.5 + 0.6 = 0.1 mA.$

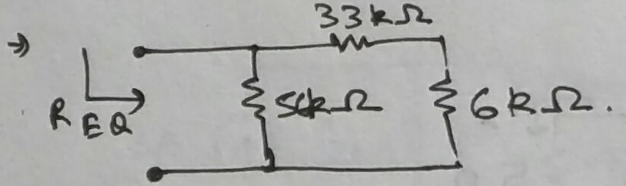
$\therefore R = 9/0.1 \times 10^{-3} = 90 k\Omega$

2.37)



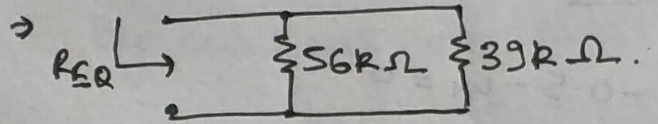
$15k\Omega \parallel 10k\Omega = \frac{15\times10}{15+10} = \frac{150}{25} = 6k\Omega$

→



33kΩ, 6kΩ series.

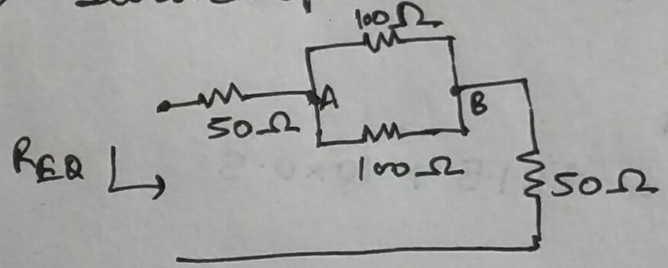
→



56kΩ || 39kΩ

$\therefore R_{EQ} = \frac{56\times39}{56+39} = 22.99k\Omega.$

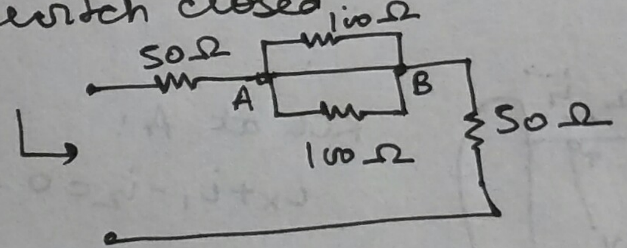
2.39) switch open.



$\Rightarrow R_{EQ} = 50 + (100 \parallel 100) + 50$

$= 50 + 50 + 50 = 150\Omega$

switch closed



short circuit b/w A, B.

let short circuit resistance be R = 0Ω.

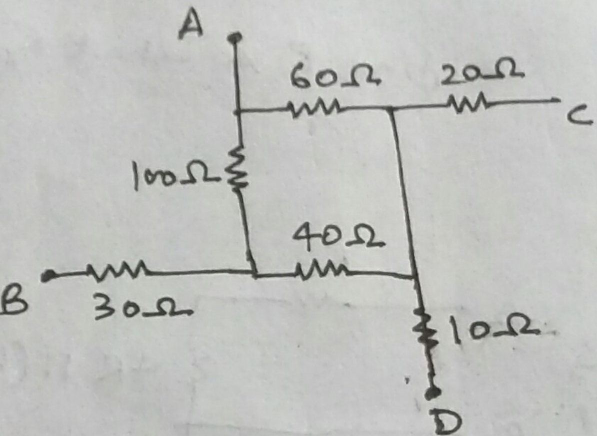
$\therefore R_{AB} = \left(\frac{1}{100} + \frac{1}{100} + \frac{1}{R}\right)^{-1}$

$= \left(\frac{R+50}{50R}\right)^{-1} = \frac{50R}{50+R} = 0$

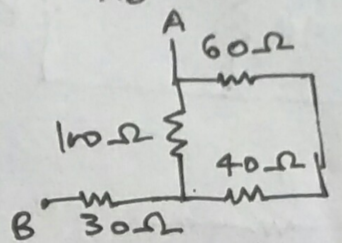
$\therefore R_{eq} = 50 + R_{AB} + 50$

$= 50 + 0 + 50 = 100\Omega.$

2.42)

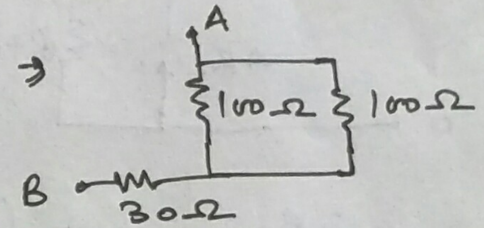


R_{AB} :



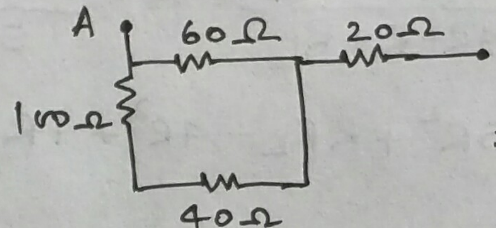
60, 40 in series.
$R = 60 + 40 = 100\ \Omega$

$\Rightarrow$

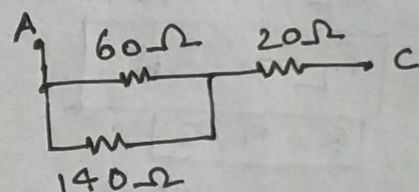


$\therefore R_{AB} = 30 + (100 \parallel 100) = 30 + 50 = 80\ \Omega$

R_{AC}



$\Rightarrow$ (100, 40 in series) $R = 100 + 40$
$= 140\ \Omega$.



$60 \parallel 140$

$$\Rightarrow R = \frac{60 \times 140}{60 + 140} = \frac{8400}{200}$$
$$= 42\ \Omega.$$

$\therefore R_{AC} = 42\ \Omega + 20\ \Omega = 62\ \Omega$.

Similarly.

$R_{AD} = (60 \parallel (100 + 40)) + 10 = (60 \parallel 140) + 10$

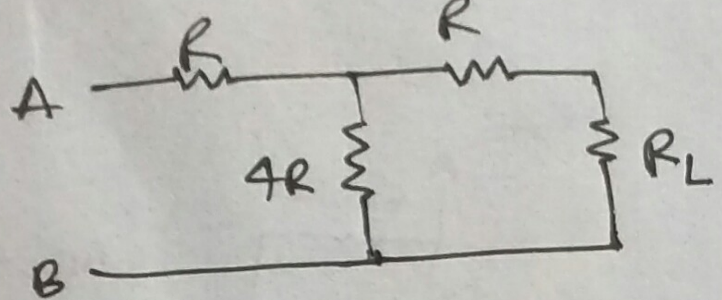
$= 42 + 10 = 52\ \Omega$

$R_{BC} = 30 + ((60 + 100) \parallel 40) + 20$
$= 30 + (160 \parallel 40) + 20$
$= 50 + \frac{160 \times 40}{160 + 40} = 50 + \frac{6400}{200} = 32 + 50 = 82\ \Omega$

$R_{BD} = 30 + ((60 + 100) \parallel 40) + 10 = 32 + 40 = 72\ \Omega$

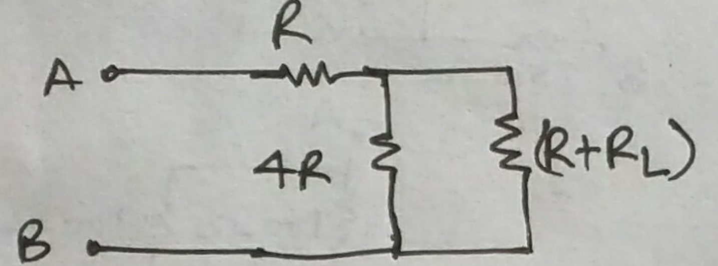
$R_{C\text{-}D} = 10 + ((60 + 100 + 40) \parallel 0) + 20 = 30\ \Omega$
(as short circuit)

2.51)

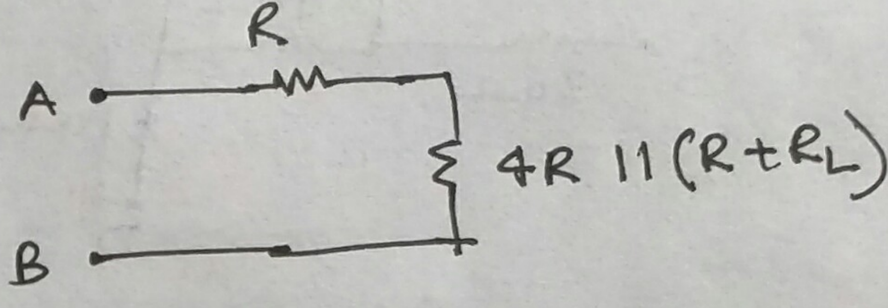


to find R so that $R_{AB} = R_L$.

⇒



⇒



$$\therefore R_{AB} = R + (4R \parallel (R+R_L))$$

$$\Rightarrow R_L = R + \frac{4R \times (R+R_L)}{4R+R+R_L} = R + \frac{4R^2 + 4RR_L}{5R+R_L}$$

$$\Rightarrow 5RR_L + R_L^2 = 5R^2 + RR_L + 4R^2 + 4RR_L$$

$$\Rightarrow R_L^2 = 9R^2$$

$$\Rightarrow \boxed{R_L = 3R}$$

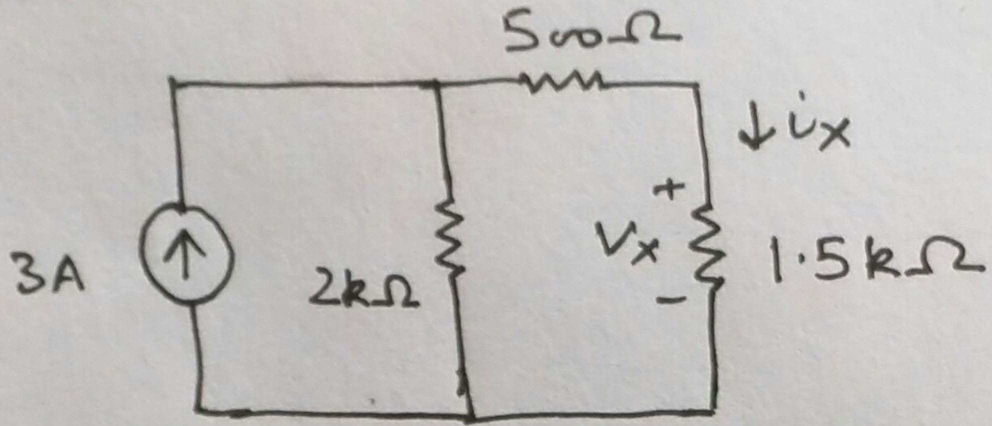
$$\Rightarrow \boxed{R = R_L/3}$$

Verify: $R_{AB} = R + (4R \parallel (R+3R))$

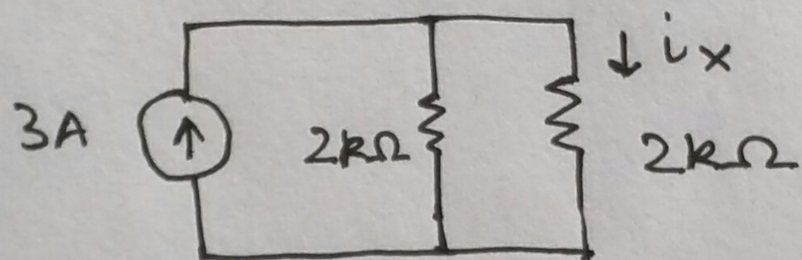
$= R + (4R \parallel 4R)$

$= R + 2R = 3R = R_L$

2.56)



↓

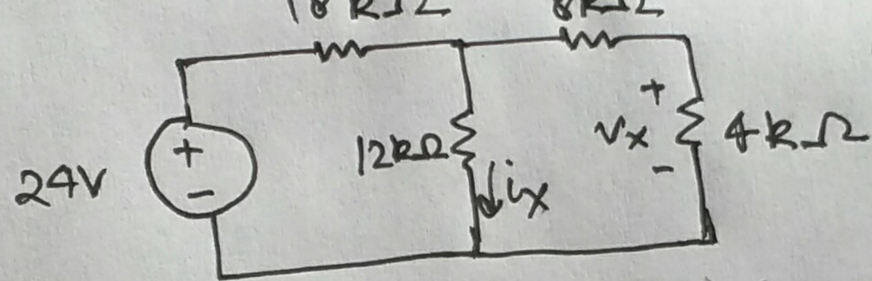


By current division,

$$i_x = \frac{2k\Omega}{2k\Omega + 2k\Omega} \times 3 = 1.5\,A.$$

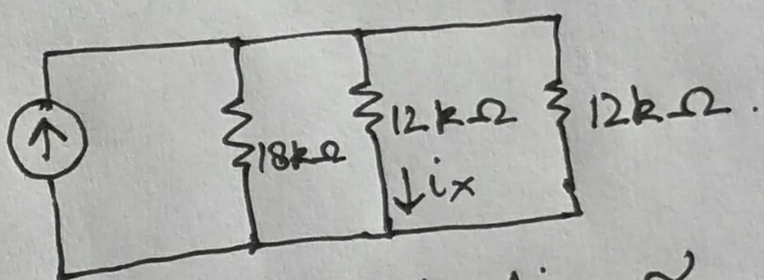
$$\therefore V_x = 1.5A \times 1.5k\Omega = 2.25\,kV$$

2.72)



↓ Source transformation & combining 8 kΩ & 4 kΩ

$\frac{24V}{18k\Omega} = \frac{4}{3}mA$



Since current distribution $\propto \frac{1}{\text{Resistance}}$. (as 18 kΩ, 12 kΩ, 12 kΩ in parallel).

current distribution in 18 kΩ, 12 kΩ, 12 kΩ is in ratio

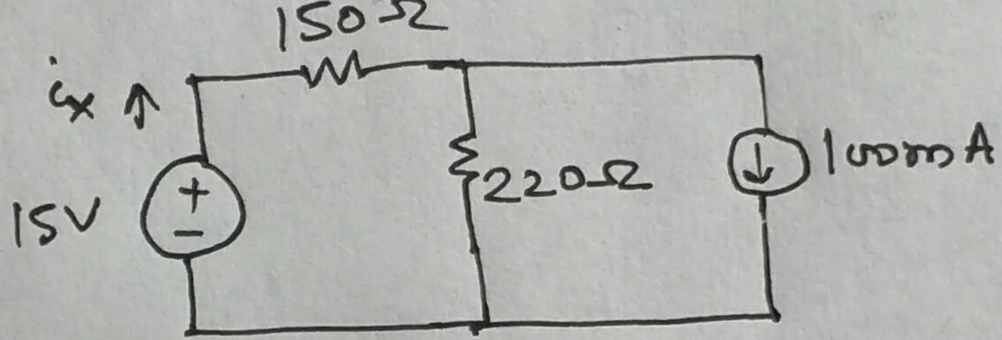
$$\frac{1}{18} : \frac{1}{12} : \frac{1}{12} = 2:3:3.$$

$$\therefore i_x = \frac{3}{8} \times \frac{4}{3} mA = 0.5 mA.$$

Also current through 4 kΩ resistor $= \frac{3}{8} \times \frac{4}{3} mA = 0.5 mA$

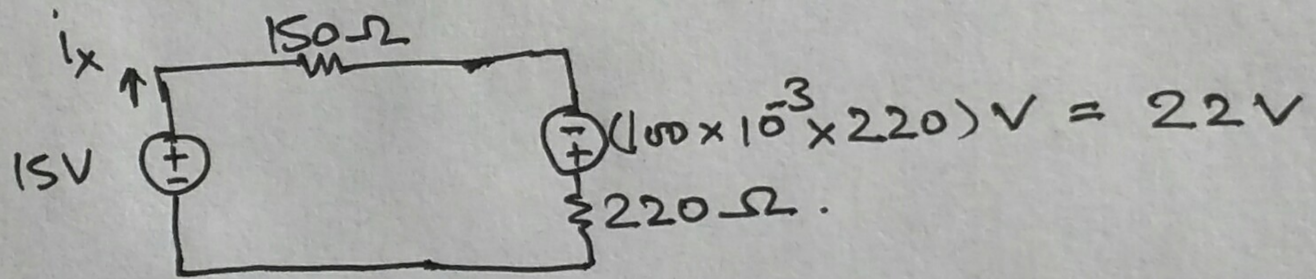
$$\therefore V_x = 0.5 \times 10^{-3} \times 4 \times 10^{3} = 2V$$

2.73)



↓

Soln:



By KVL: $-15 + 150 \times i_x - (22) + 220\, i_x = 0$

$\Rightarrow \quad i_x = 100\,mA$