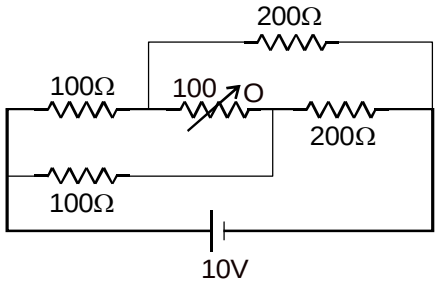
EXERCISE – V

JEE QUESTIONS

1.



Wheat stone bridge

2. (i) $I = \frac{\Delta Q}{\Delta t}$ remains constant.

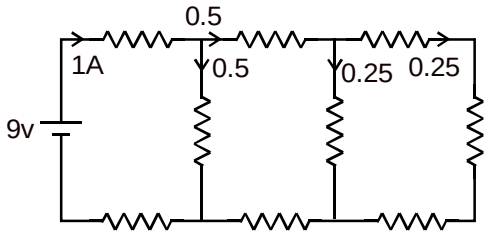
(ii) $R = \frac{\rho \ell}{A} \Rightarrow Q = \frac{RA}{\ell}$

$\sigma = \frac{1}{\rho} = \frac{\ell}{AR} = \frac{[L]}{[L^2][ML^2T^{-3}A^{-2}]}$

$= [M^{-1}L^{-3}T^3A^2]$

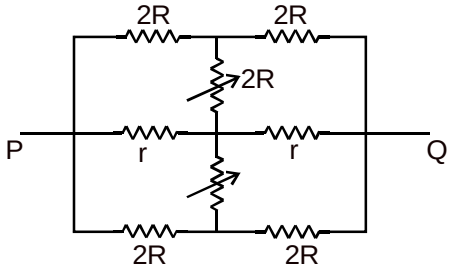
Notes $\frac{V_1r_2 + V_2r_1}{r_1 + r_2}$, $\frac{r_1r_2}{r_1 + r_2}$

3.



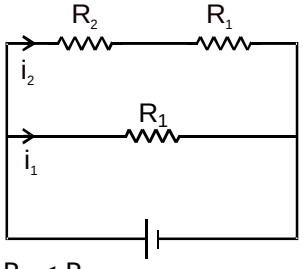
4. Wheat stone bridge is balanced.

5.



Symmetric circuit

6.

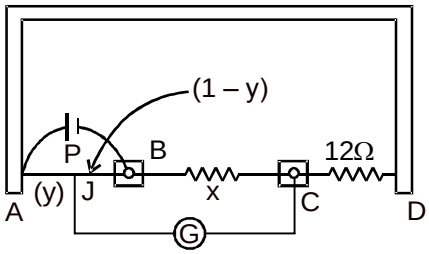


$R_2 < R_1$

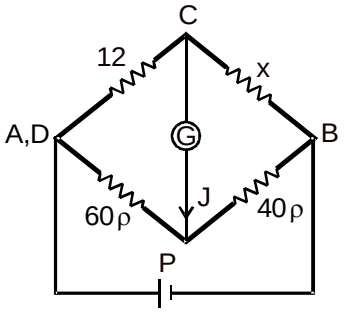
$i_1 > i_2$

7. (a) No

(b)



(c)



8Ω

In balance condition

$12 \times 40\ \rho = x\ 60\ \rho$

$\boxed{x = 8\Omega}$

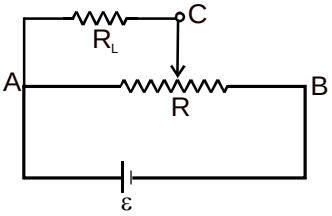
8. For power maximum

$\Rightarrow r_{max}$

$P = i^2r$

9. Potential gradient does not depend on area of cross section.

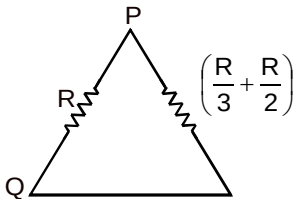
10.



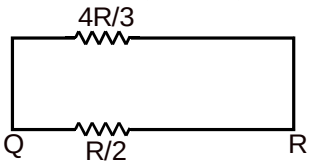
Output can be taken across the terminals A and C or B and C.

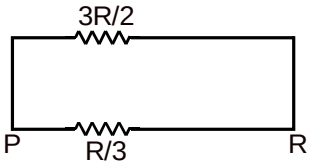
11. (A) $R_{PQ} = \frac{R\left(\frac{5R}{6}\right)}{R + \frac{5R}{6}} = \frac{5R}{11}$

(B) $R_{QR} = \frac{\frac{4R}{3} \times \frac{R}{2}}{\frac{4R}{3} + \frac{R}{2}} = \frac{4R}{11}$



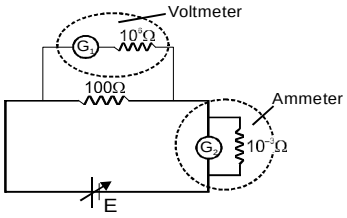
(C) $R_{PR} = \dfrac{\left(\frac{3R}{2}\right)\left(\frac{R}{3}\right)}{\left(\frac{3R}{2}+\frac{R}{3}\right)} = \dfrac{3R}{11} = \dfrac{3R}{11}$





12. C

13.



14. Jayega to Ayega kahan se isliye zero hai.

15. $i = 100 \times 10^{-6}\left(1+\dfrac{100}{0.1}\right)$ $\left\{i = i_g\left(1+\dfrac{r_g}{R}\right)\right.$ = 100.1 mA

16. Error Ka sawal hai. **[JEE 2005]**

$x.\ \ell_1 = R \times \ell_2$

$R = \dfrac{x\ell_1}{\ell_2} \Rightarrow x = \dfrac{R\ell_2}{\ell_1}$

$dx = \dfrac{R.d\ell_2}{\ell_1} - \dfrac{R.d\ell_1.\ell_2}{\ell_1^2}$

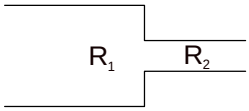
For error

$\dfrac{dx}{x} = \dfrac{d\ell_2}{\ell_2} + \dfrac{d\ell_1}{\ell_1}$

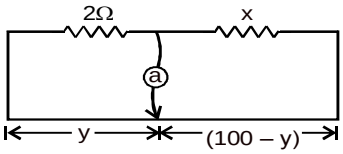
minimum for $\ell_1 = \ell_2$

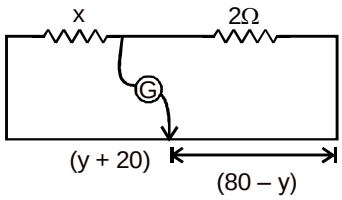
17. $R = \dfrac{\rho\ell}{A}$

$R_1 = \dfrac{\rho\ell}{2\pi(2r)^2}$ $\quad R_2 = \dfrac{\rho\ell}{2\pi r^2} = \dfrac{R_2}{4}$



18.





$x > 2\Omega$

$2(100 - y) = xy$ ...(1)

$x\ (80 - y) = 2(y + 20)$ ...(2)

19. For R_1

Wheat stone Bridge

$R_1 = 1\Omega$

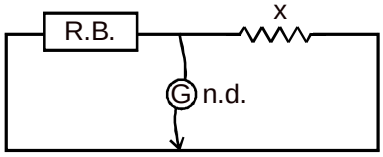
for $R_2 = 0.5\ \Omega$

for $R_3 = 2\Omega$

Power $P = \dfrac{V^2}{R}$

$P_2 > P_1 > P_3$

20.



If x↑ & null deflection remains same R.B. should increase.

21. $R_{total} = 2 + \dfrac{6\times1.5}{6+1.5} = 3.2\ k\Omega$

(A) $I = \dfrac{24V}{3.2k\Omega} = 7.5\ mA = I_{R_1}$

$I_{R_2} = \dfrac{R_L}{R_L + R_2}\ I = 1.5\ mA$

$I_{R_L} = 6mA$

(B) $V_{R_L} = (I_{R_L})(R_L) = 9V$

(C) $\dfrac{P_{R_1}}{P_{R_2}} = \dfrac{I_{R_1}^2 R_1}{I_{R_2}^2 R_2} = \dfrac{25}{3}$

(D) When R_1 & R_2 are interchanged $\dfrac{R_2R_L}{R_2+R_L} = \dfrac{6}{7}k\Omega$

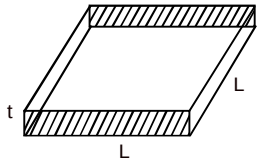
Earlier it was 9V

$P \propto V^2$

Since Pot. difference decreases three times therefore, power dissipated will decreases 9 times.

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

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

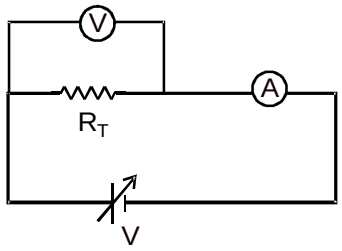


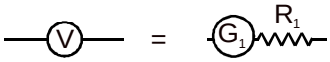
$R = \frac{\rho}{t}$

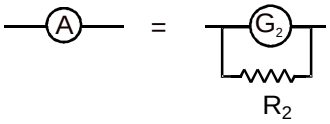
23. $P = \frac{V^2}{R}$ & 100 W > 60 W > 40 W

$\frac{V^2}{R_{100}} > \frac{V^2}{R_{60}} > \frac{V^2}{R_{40}} \Rightarrow \frac{1}{R_{100}} > \frac{1}{R_{60}} > \frac{1}{R_{40}}$

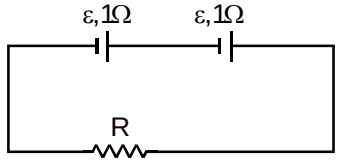
24.



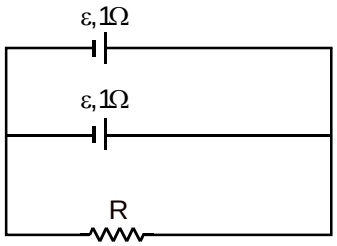




25.



$I_1 = \left(\frac{2\varepsilon}{R+2}\right)^2 R$

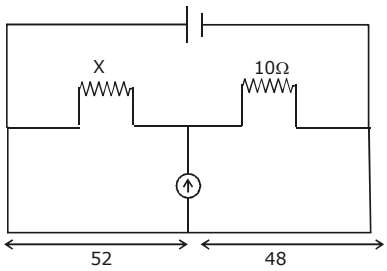


$I_2 = \left(\frac{\varepsilon}{R+1/2}\right)^2 R \Rightarrow \frac{I_1}{I_2} = 2.25 \Rightarrow R = 4\Omega$

26. B

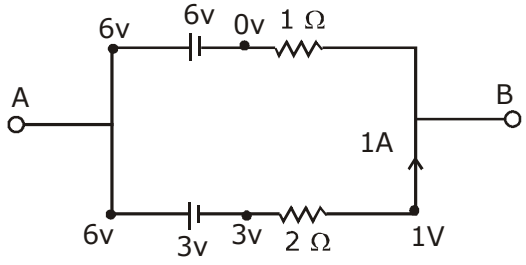
$\ell = 52 + 1 = 53$

$\ell' = 48 + 2 = 50$



$\frac{x}{10} + \frac{\ell}{\ell'} \Rightarrow x = \frac{530}{50} = 10.6$ ohm

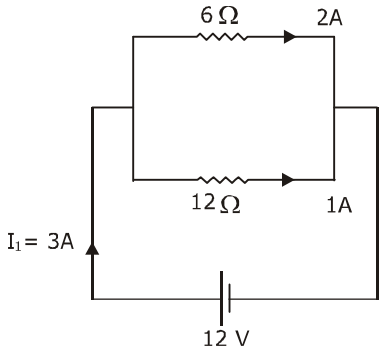
27.



$v_{AB} = 5$ V

28.

By symmetry the $1\,\Omega$ resistances don't get any current so circuit reduces to



$I_1 = \frac{12}{\frac{6\times12}{6+12}} = 3A$