DPP – 9

SOLUTION

Link to View Video Solution: Click Here

1. $4 \times DC = Y \times AD$

$\Rightarrow 4 \times 60 = Y \times 40$

$Y = 6\Omega$

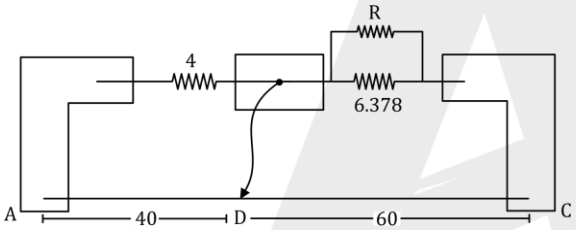
For y $R_f = 6(1 + 6.3 \times 10^{-4} \times 100)$

$R_f = 6[1 + 0.063] = 1.063 \times 6$

$R_f = 6.378\Omega$

After heating Y, resistance of Y is 6.378Ω

Y connected with a unknow resistance R.



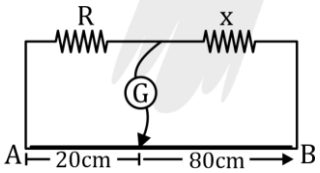
$$4 \times 60 = 40 \times \frac{R(6.378)}{R + 6.378}$$

$6R + 6 \times 6.378 = 6.378 \times R$

$0.378R = 6 \times 6.378$

2. $\frac{R}{20} = \frac{x}{80} \Rightarrow \frac{R}{x} = \frac{1}{4}$

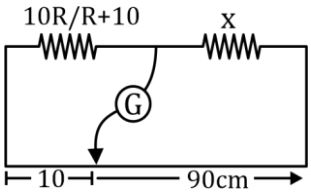
$x = 4R$ _____ (i)



When 10Ω connected in parallel to R.

$$\frac{\left(\frac{10R}{10+R}\right)}{10} = \frac{x}{90}$$

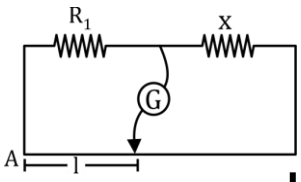
$\Rightarrow x = 50\Omega$



3. $\frac{R_1}{x} = \frac{l}{100-l}$

$\Rightarrow \frac{100}{x} = \frac{20}{80}$

$x = 400\Omega$



Link to View Video Solution: Click Here

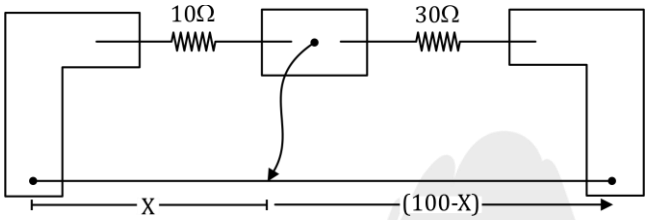
$x = \frac{\rho l}{A} = \frac{\rho l}{\left(\frac{\pi d^2}{4}\right)} \quad \Rightarrow d = 1\text{ mm} \Rightarrow \quad d = 1 \times 10^{-3}$

$400 = \frac{\rho \times 20 \times 10^{-3}}{\pi \times 10^{-6}} \times 4$

$5 \times \pi \times 10^{-3} = \rho$

$\rho = 5\pi \times 10^{-3}$

4.

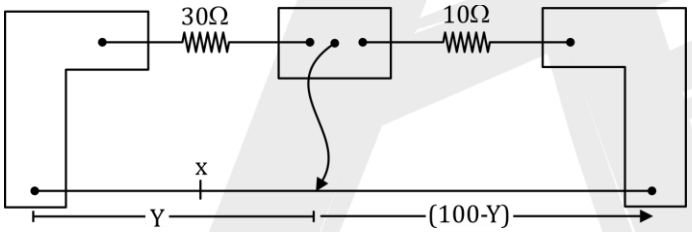


$30x = (100 - x)10$

$3x = 100 - x$

$x = 25\text{ cm}$

when resistance Interchanged



$10Y = 30(100 - Y) \Rightarrow Y = 300 - 3Y$

$4Y = 300 \Rightarrow Y = 75$

So balance point shift by $y - x$

$= 75 - 25 = 50\text{ cm}$

5. $R \times 60 = 90 \times 40$

$R = \frac{180}{3} = 60\Omega$

$\frac{R}{90} = \frac{l}{(100-l)}$ $[l = 40\text{ cm}]$

$R = 90 \cdot \frac{l}{(100-l)} \quad \Rightarrow \quad \frac{\Delta R}{R} = \frac{\Delta l}{l} + \frac{\Delta l}{(100-l)} = \frac{0.1}{40} + \frac{0.1}{60}$

$\Delta R = 0.25 \quad \Rightarrow \quad R = (60 \pm 0.25)\Omega$

6. most sensitive when the resistance of all the four arms of bridge is same

For the resistor B the value of x is the most accurate answer.

Link to View Video Solution: Click Here

7. $\frac{R}{X} = \frac{\ell}{100-\ell}$

$\Rightarrow X = \frac{R(100-\ell)}{\ell}$

For $1, X = \frac{100\times40}{60} = \frac{2000}{3}\Omega = 667\Omega$

For $2, X = \frac{100\times87}{13} = \frac{8700}{13}\Omega = 669\Omega$

For $3, X = \frac{10\times98.5}{1.5} = \frac{1970}{3}\Omega = 656\Omega$

For $4, X = \frac{1\times99}{1} = 99\Omega$

Clearly, we can see that the value of X calculated CASE-4 is inconsistent with the other values.

Hence, the correct answer is (D).

8. The ratio $\frac{AC}{CB}$ will remain unchanged.

9. Since $\frac{dR}{d\ell} = \frac{K}{\sqrt{\ell}}$

$\Rightarrow \int_0^R dR = K\int_0^\ell \frac{d\ell}{\sqrt{\ell}}$ $\Rightarrow R = 2K\sqrt{\ell}$

$\Rightarrow \frac{R}{R'} = \frac{2K\sqrt{\ell}}{2K(1-\sqrt{\ell})} = \frac{\sqrt{\ell}}{1-\sqrt{\ell}}$

Since $R = R'$

$\Rightarrow \frac{\sqrt{\ell}}{1-\sqrt{\ell}} = 1$ $\Rightarrow 2\sqrt{\ell} = 1$

$\Rightarrow \ell = \frac{1}{4} = 0.25$ m Hence, the correct answer is (C).