DPP – 8 (Current Electricity)

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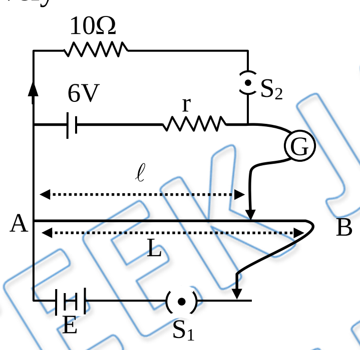
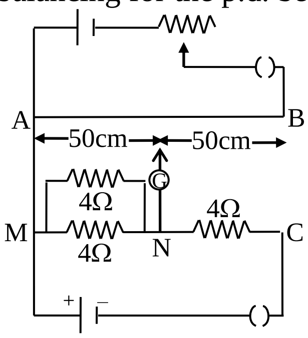
Q 1. In the arrangement shown in figure when the switch S_2 is open, the galvanometer shows no deflection for l = L/2. When the switch S_2 is closed, the galvanometer shows no deflection for l = 5L/12. The internal resistance (r) of 6 V cell, and the emf E of the other battery are respectively-



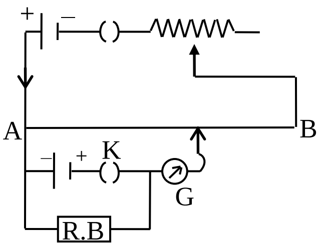
(A) 3ohm, 8V (B) 2ohm, 12V
(C) 2ohm, 24V (D) 3ohm, 12V

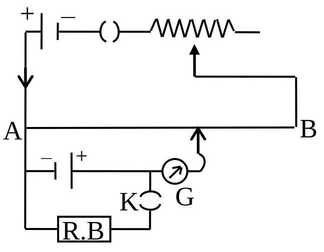
Q 2. In the following figure, the p.d. between the points M and N is balanced at 50 cms length. The length in cms, balancing for the p.d. between points N and C will be –

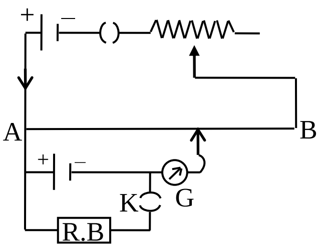


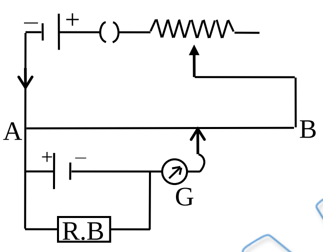
(A) 40 (B) 100
(C) 75 (D) 25

Q 3. Correct diagram for the determination of internal resistance of a primary cell by potentiometer

(A) 

(B) 

(C) 

(D) 

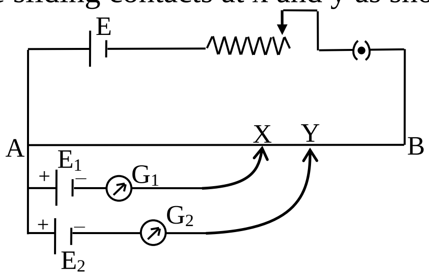
Q 4. With two resistance R_1 and R_2 ($>R_1$) in the two gaps of a metre bridge the balance was found to be 1/3 m from the zero end. When a 6 Ω resistance is connected in series with the smaller of the two resistance, the point is shifted to 2/3 m from the same end, then R_1 and R_2 are -

(A) 2Ω, 4 Ω (B) 3 Ω, 6 Ω
(C) 4 Ω, 8 Ω (D) 4 Ω, 2 Ω

Q 5. A wire connected in the left gap of a metre bridge balances a 10ohm resistances in the right gap at a point which divides the bridge wire in the ratio 3:2. Then the resistance of the wire will be -

(A) 5ohm (B) 10ohm
(C) 15ohm (D) 20ohm

Q 6. A potentiometer experiment is setup as shown in fig. If both the galvanometer shows null deflections for the sliding contacts at x and y as shown then -

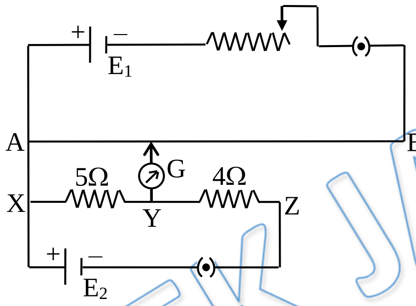


(A) $E_1 = E_1$ (B) $E_1 > E_2$
(C) $E_1 < E_2$ (D) none of the above

Q 7. A cell of emf (E) and internal resistance (r) is balanced across (l) length of potentiometer wire. If another cell of emf 2E and internal resistance (2r) is connected in parallel to the first cell , then the balancing length will be

(A) l/3 (B) 2 l /3
(C) 4 l/3 (D) 2 l

Q 8. In a potentiometer arrangement shown in fig. The balancing length for p.d. across xy points is found to be 45.5cm. Then the balancing length for p.d. across (Y) and (Z) would be



(A) 45.50 cm (C) 36.40 cm
(B) 56.87 cm (D) none of the above

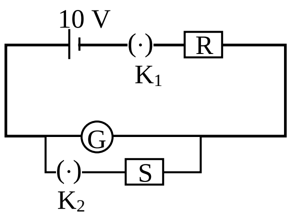
Q 9. A 6 volt battery is connected to the terminals of a three metre long wire of uniform thickness and resistance of 100 ohm. The difference of potential between two points on the wire separated by a distance of 50 cm will be -

(A) 2 volt (B) 3 volt
(C) 1 volt (D) 1.5 volt

Q 10. In an experiment on measurements of emf of a cell by a potentiometer, the balancing length for a cell of emf E and internal resistance r is found to be l. Now if another cell of emf E and internal resistance 2r is connected in parallel to the first cell and balancing length determined, then the balancing length will be-

(A) l (B) 2 l
(C) 2l/3 (D)none

Q 11. If galvanometer has 500 ohm resistance and R = 5000 ohm, then what should be the resistance connected to galvanometer in parallel to it so that its deflection reduces to half –

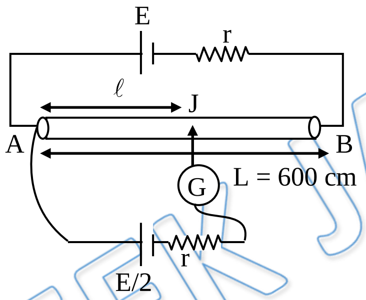


(A) 544 ohm (B) 500 ohm
(C) 455 ohm (D) None

Q 12. A meter bridge with resistance R_1 and R_2 connected in two gaps is balanced at 0.4 m from zero end. If smaller resistance is connected in series with 10 ohm resistance, the balance point is shifted to 0.4 m from other end. The value of smaller resistance is -

(A) 40 ohm (B) 60 ohm
(C) 20 ohm (D) 8 ohm

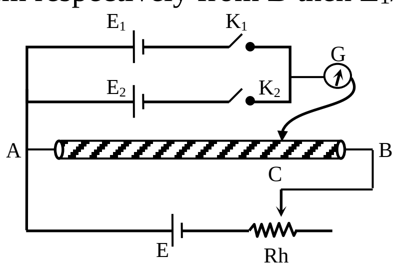
Q 13. If resistance of potentiometer wire = 15 r then calculate the balance length l :



(A) 320 cm (B) 200 cm
(C) 400 cm (D) 100 cm

Q 14. A 10 m long wire of resistance 20 ohm is connected in series with a battery of emf 3V (negligible internal resistance) and a resistance of 10 ohm. Find the potential gradiant along the wire –
(A) 3 V/m (B) 0.2 V/m
(C) 0.1 V/m (D) 0.3 V/m

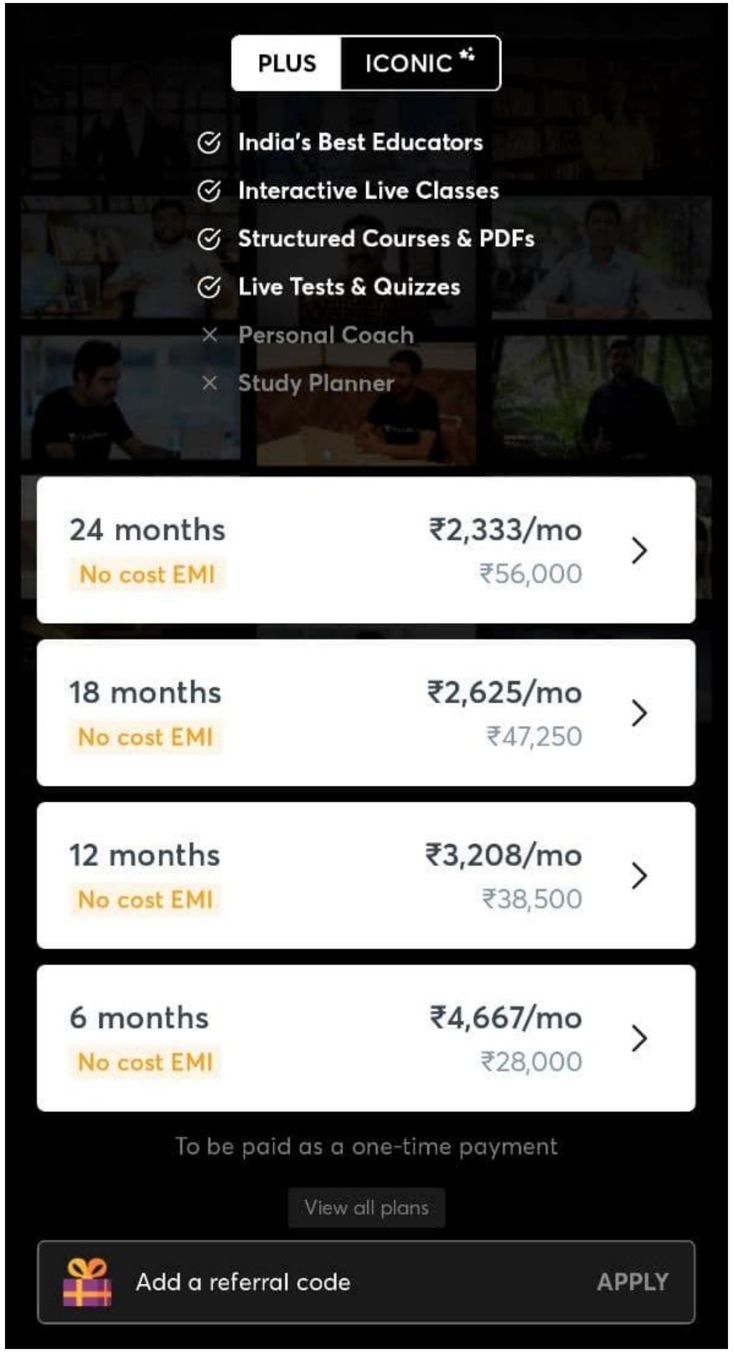
Q 15. Figure shows the potentiometer arrangement to compare the emf of cells E_1 and E_2. Length of the resistance wire AB is 100 cm. If null point obtained for E_1 and E_2 are at distance 20 cm and 40 cm respectively from B then E_1/E_2 is –



(A) 1 : 2 (B) 4 : 5
(C) 3 : 2 (D) 4 : 3

Answer Key

Q.1 b	**Q.2 b**	**Q.3 c**	**Q.4 a**	**Q.5 c**
Q.6 c	**Q.7 c**	**Q.8 c**	**Q.9 c**	**Q.10 a**
Q.11 c	**Q.12 d**	**Q.13 a**	**Q.14 b**	**Q.15 d**



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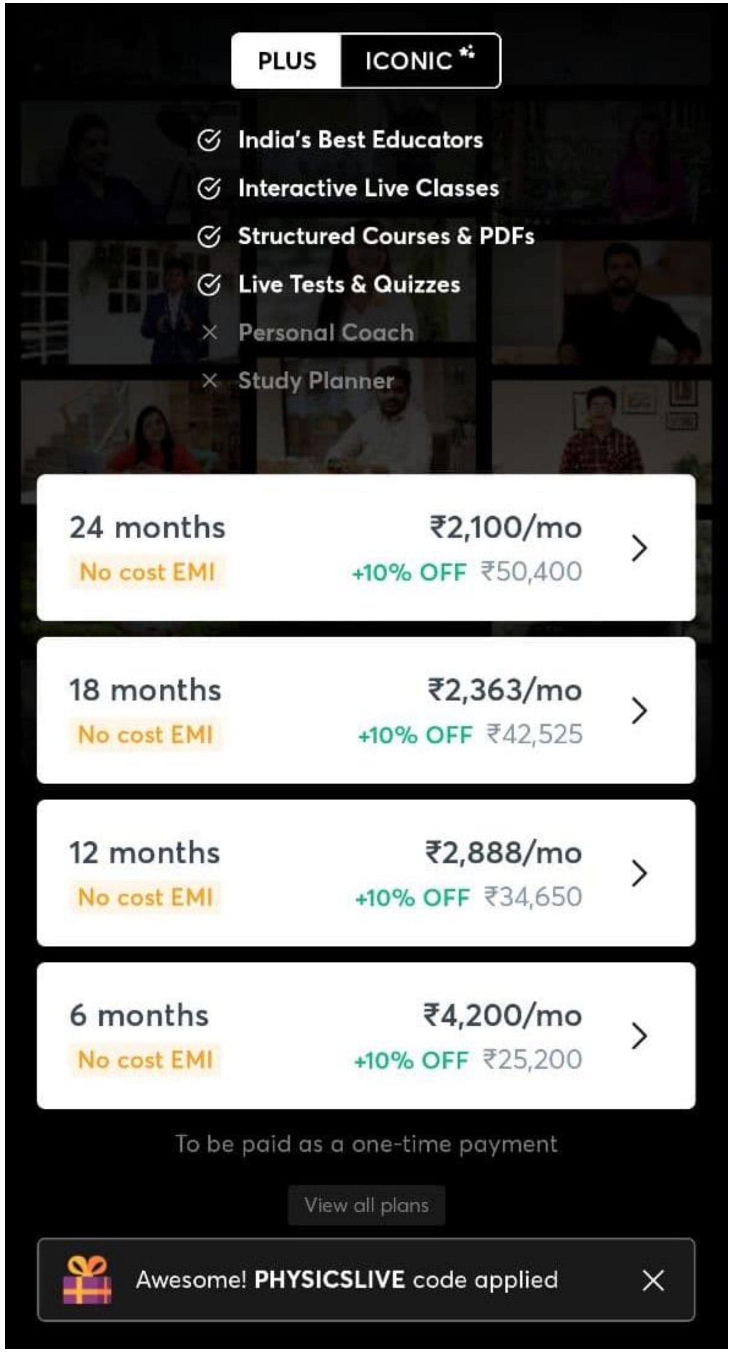

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Written Solution

DPP-8 Current Electricity: meter bridge, potentiometer, post office box

By Physicsaholics Team

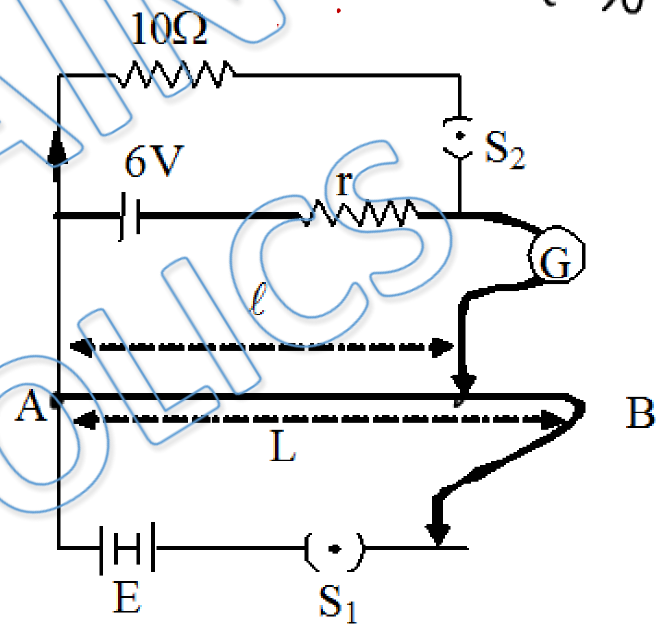
Solution: 1

internal resistance

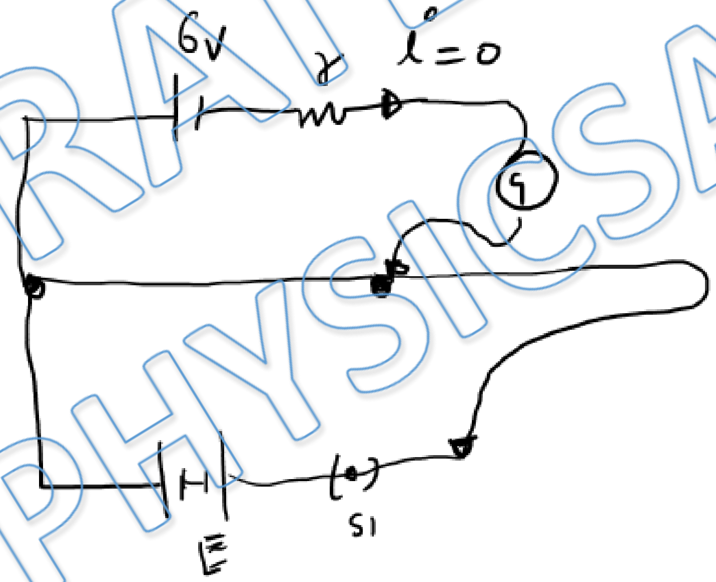
$$r = R\left[\frac{l_2 - l_1}{l_1}\right]$$

$$r = 10\left[\frac{L/2 - 5L/12}{5L/12}\right] = 2\Omega$$

$r = R\left(E/V - 1\right)$



EMF of cell



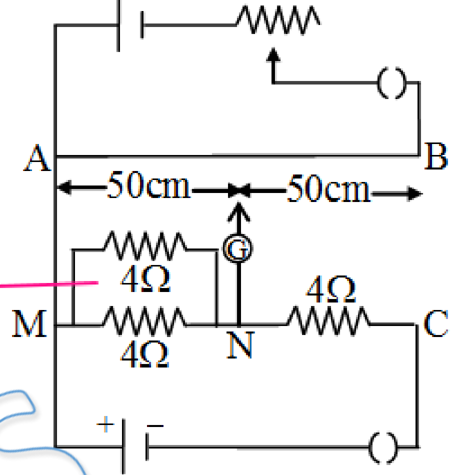
Potential drop by 6V battery is 6V

$$6V = \frac{E}{L}\cdot\frac{L}{2}$$

$$\boxed{E = 12V}$$

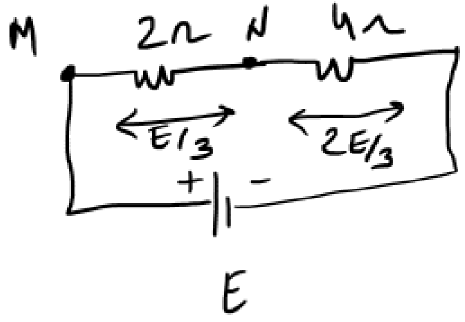
Ans. b

In the following figure, the p.d. between the points M and N is balanced at 50 cms length. The length in cms, balancing for the p.d. between points N and C will be –



Solution: 2

①



⇒ in the first case p.d b/w MN is equal to p.d through 50 cm wire.

$E/3 = K \times 50$ {K = Potential gradient}

$K = E/150$ — ①

⇒ In 2nd case the P.D b/w N & C is $2E/3$ hence, we can write as

$2E/3 = Kx$

$2E/3 = E/150 \cdot x$ ⇒ $x = 100\,cm$

Ans. b

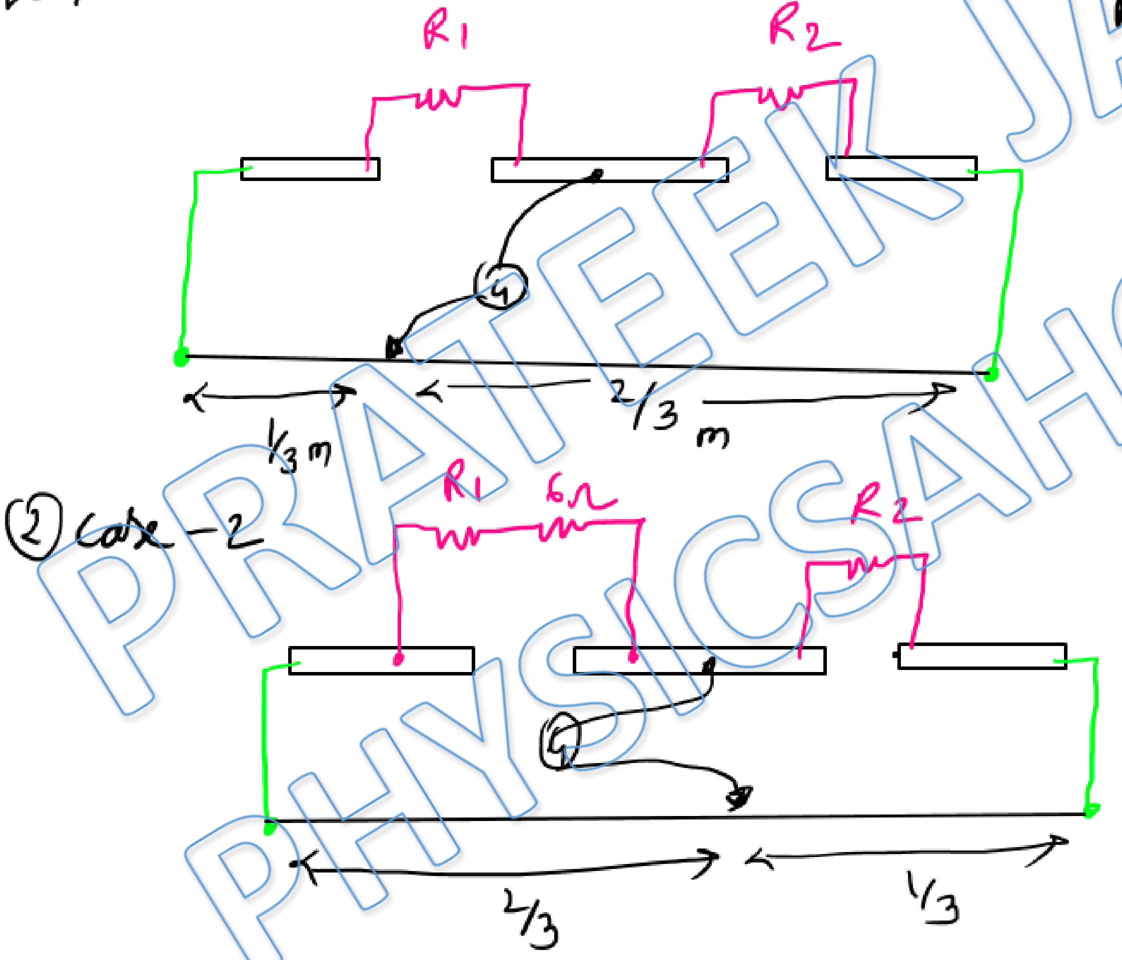
Solution: 3

this is an standard arrengement option c

Ans. c

Solution: 4

① case :–



$R_1 \times 2/3 = R_2 \times 1/3$

$R_2 = 2R_1$ — ①

$(R_1 + 6) \times 1/3 = R_2 \times 2/3$

$(R_1 + 6) = 2 \cdot (2R_1)$

$R_1 + 6 = 4R_1$

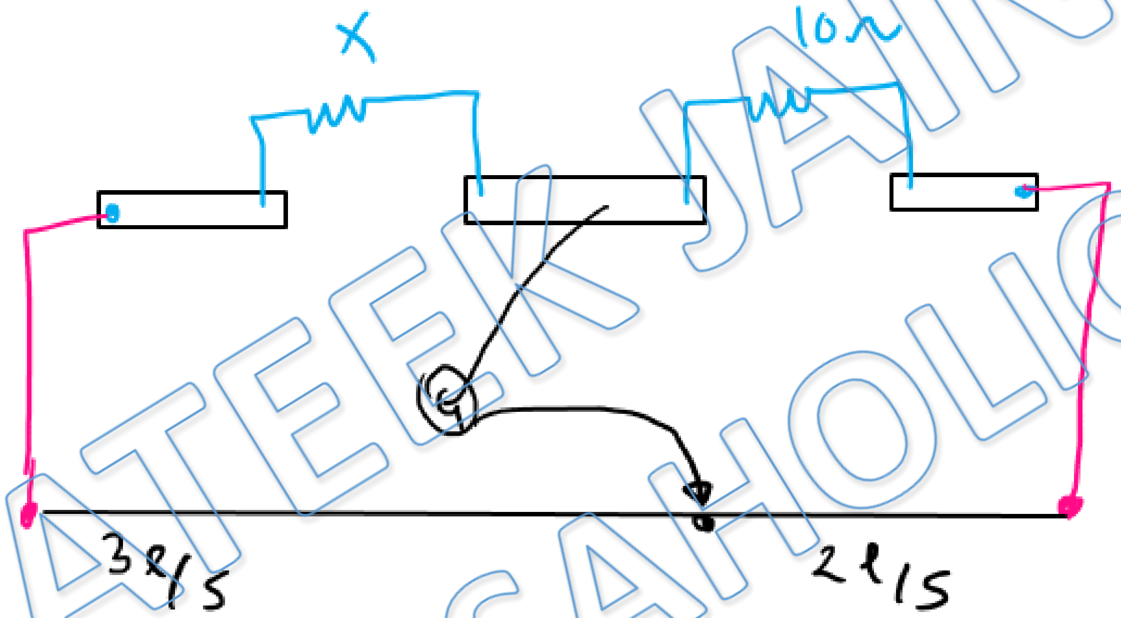
$6 = 3R_1$

$R_1 = 2\Omega$

$R_2 = 4\Omega$

Ans. a

Solution: 5

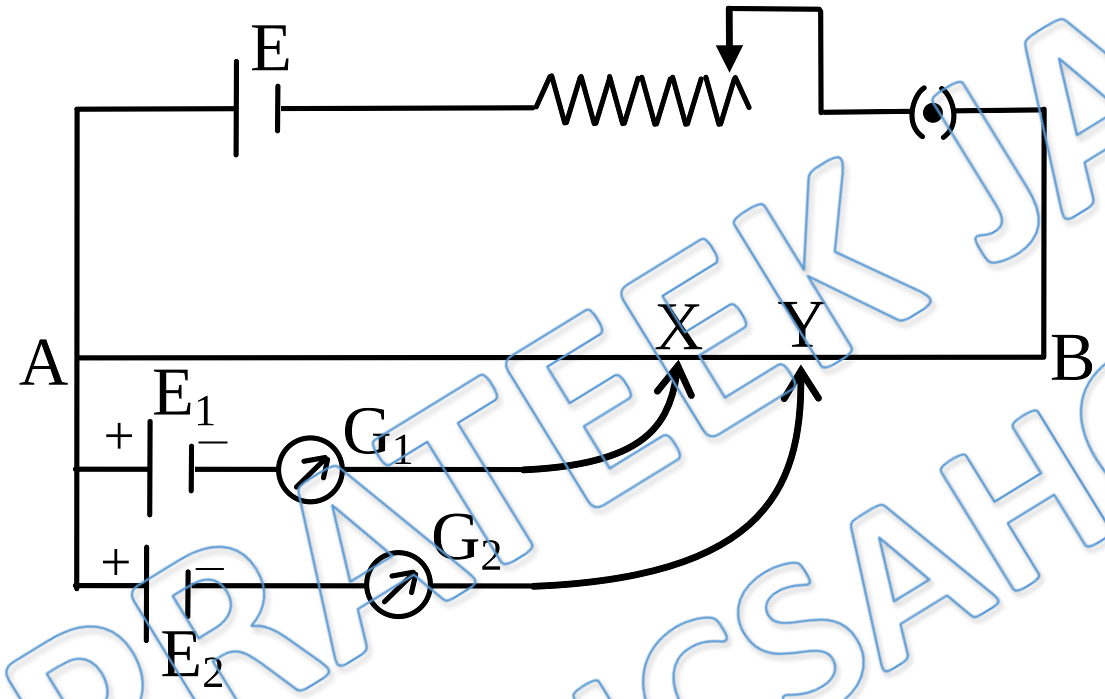


$$\frac{3l}{5} \times 10 = x \times \frac{2l}{5}$$

$$x = \frac{3}{2} \times 10 = 15\,\Omega$$

Ans. c

Solution: 6



E=kx , more the length of balancing point more will be emf of that battery and hence C is correct option as Y>X

Ans. c

Solution: 7

in case of (1) cell

$$\boxed{E = K\ell} \Rightarrow K = E/\ell \quad -①$$

in case when both are connected parallel.

$$E_{nt} = \frac{E_1/r_1 + E_2/r_2}{1/r_1 + 1/r_2} = \frac{E/r + 2E/2r}{1/r + 1/2r} = \frac{2E/r}{\frac{3}{2r}} \Rightarrow 4E/3$$

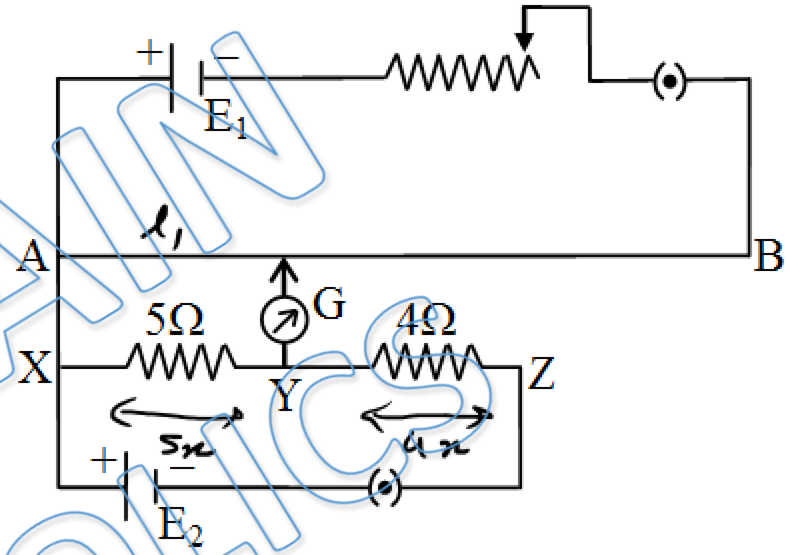
if $E_{nt} = E$, means balancing Point will not change.

$$E_{nt} = K\ell' \quad \text{from ①}$$

$$4E/3 = E/\ell \cdot \ell' \Rightarrow \boxed{\ell' = 4\ell/3}$$

Ans. c

In a potentiometer arrangement shown in fig. The balancing length for p.d. across xy points is found to be 45.5cm. Then the balancing length for p.d. across (Y) and (Z) would be



Solution: 8

⇒ drop b/w X & Y is $\frac{5E_2}{9}$

$9x = E_2$

$x = E_2/9$

$\frac{5E_2}{9} = k\,l_1 = k \cdot 45.5 \quad -(1)$

$k = \frac{5}{9}\frac{E_2}{45.5}$

⇒ drop b/w Y & Z is $4E_2/9$

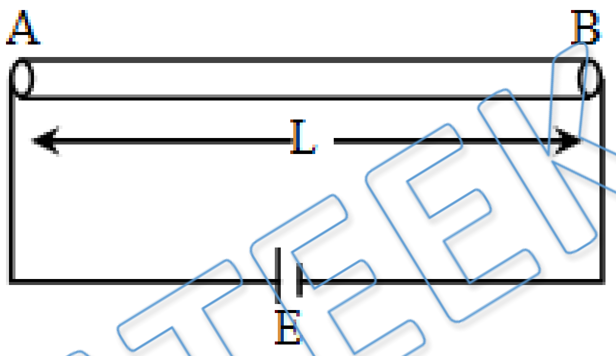
$\frac{4E_2}{9} = k\,l_2$

$\frac{4E_2}{9} = \frac{5}{9}\frac{E_2}{45.5} \cdot l_2 \Rightarrow$ $\boxed{l_2 = 36.4\text{ cm}}$

Ans. c

Solution: 9

$V_{AB} = E$



$\therefore$ Potential gradient $K = \dfrac{V_{AB}}{L} = \dfrac{E}{L}$

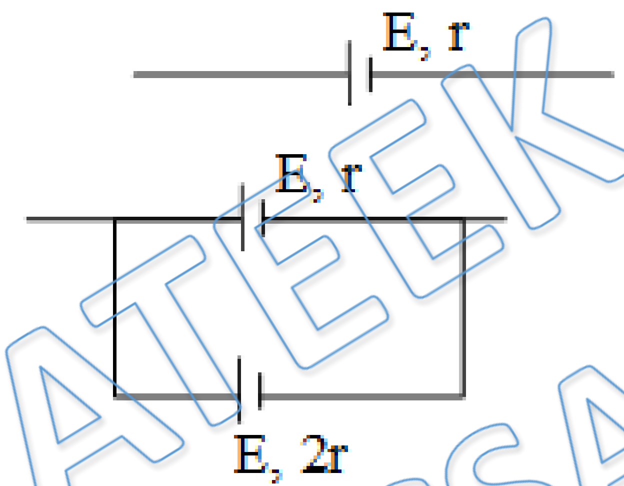
$\therefore$ Potential difference across length ℓ is $V = K\ell$

$= \dfrac{E}{L} \times \ell = \dfrac{6}{3} \times 0.5 = 1$ volt

Ans. c

Solution: 10

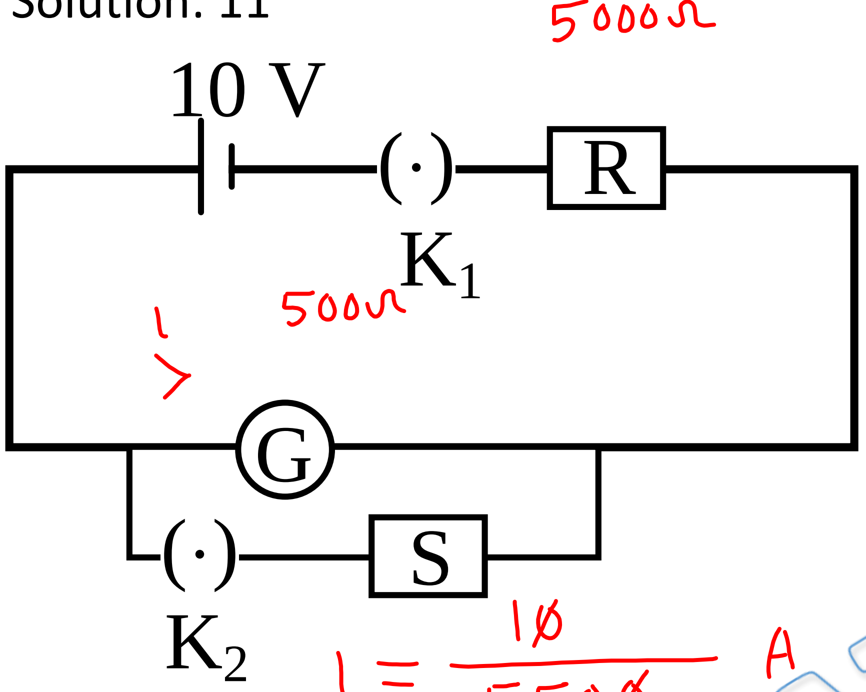
Sol. balancing length = ℓ

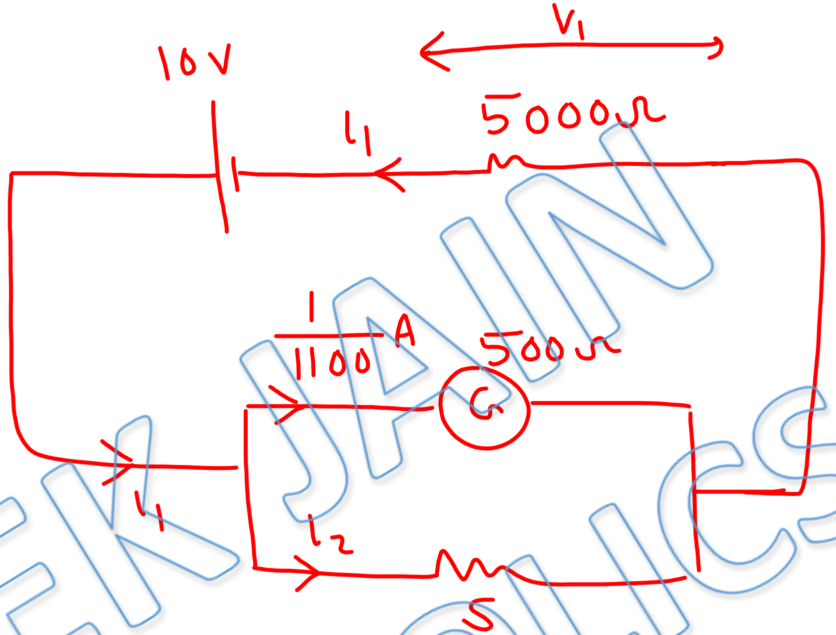


$E_{net} = E \Rightarrow$ balancing length = ℓ

Ans. a

Solution: 11





$$I = \frac{10}{5500}\ A$$

$$\frac{I}{2} = \frac{1}{1100}\ A$$

$$V = \frac{500}{1100} = \frac{5}{11}\ V$$

$$\Rightarrow V_1 = 10 - \frac{5}{11} = \frac{105}{11}\ V \Rightarrow I_1 = \frac{105}{11 \times 5000}$$

$$I_1 = \frac{21}{11000}\ A \Rightarrow I_2 = \frac{21}{11000} - \frac{1}{1100} = \frac{21-10}{11000}$$

$$\Rightarrow I_2 = \frac{11}{11000} = \frac{1}{1000}\ A$$

$$\Rightarrow S = \frac{V}{I_2} = \frac{5 \times 1000}{11 \times 1} \simeq 455\ \Omega$$

Ans. c

Solution: 12

$$\frac{R_1}{R_2} = \frac{0.4}{0.6} \Rightarrow \frac{R_1}{R_2} = \frac{2}{3}$$

$$\frac{R_1 + 10}{R_2} = \frac{0.6}{0.4} \Rightarrow \frac{R_1 + 10}{3/2\,R_1} = \frac{3}{2}$$

$$\therefore R_1 = 8\,\Omega$$

Ans. d

Solution: 13

Sol. [A] P.D of ext. ckt = $\phi \times$ balance length

$$E/2 = \left(\frac{E}{L} \times \frac{R_w}{R_w + r}\right) \times \ell$$

$$\text{or } E/2 = \frac{E}{600} \times \frac{15r}{16r} \times \ell$$

$$\therefore \ell = \frac{600 \times 16}{30} = 320 \text{ cm}$$

Ans. a

Solution: 14

Sol.[B] $\phi = (R_{wire}) \times \frac{I}{\ell}$

$$I = \frac{\varepsilon}{(R_{wire} + R_{external})} = \frac{3}{(20+10)} = \frac{3}{30} = 0.1A$$

$$\phi = \frac{20 \times 0.1}{10} = 0.2 \text{ V/m}$$

Ans. b

Solution: 15

Sol.[D] $E_1 = Q \times \ell_1$ ..... (1)

$E_2 = Q \times \ell_2$ ...... (2)

$$\frac{E_1}{E_2} = \frac{\ell_1}{\ell_2} = \frac{80}{60} = \frac{4}{3}$$

(ℓ_1 & ℓ_2 should be measured from A)

Ans. d

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