Physicsaholics

DPP – 7 (Current Electricity)

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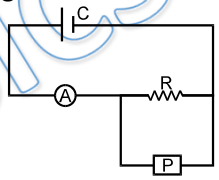
Q 1. If following meters are prepared with help of identical galvanometer. In which of the case resistance of the device will be largest?
(a)An ammeter of range 10 A (b)A voltmeter of range 5 V
(c)An ammeter of range 5 A (d)A voltmeter of range 10 V

Q 2. A bulb rated 200 W, 200 V is used at 100 V. Then the number of electrons passed through bulb in one second is
(a) 3.125×10^{17} (b) Zero
(c) 3.125×10^{18} (d) 6.25×10^{18}

Q 3. ' n' identical light bulbs, each designed to draw power of P watts from a certain voltage supply are joined in series and that combination is connected across that supply. The power consumed by one bulb (in watts) will be
(a) n P (b) P (c) P/n (d) P/n^2

Q 4. An ammeter A of finite resistance and a resistor R are joined in series to an ideal cell C. A potentiometer P is joined in parallel to R. The ammeter reading is I_0 & the potentiometer reading is V_0. P is now replaced by a voltmeter of finite resistance. The ammeter reading now is I and the voltmeter reading is V.



(a) $I > I_0$, $V > V_0$ (b) $I > I_0$, $V < V_0$
(c) $I = I_0$, $V < V_0$ (d) $I < I_0$, $V = V_0$.

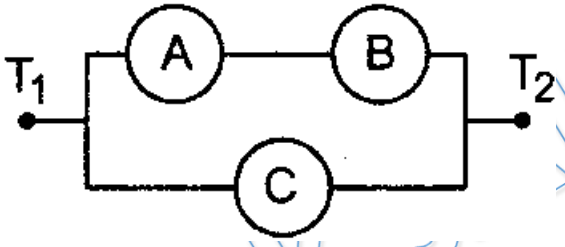
Q 5. In a potentiometer arrangement E_1 is the cell establishing current in primary circuit E_2 is the cell to be measured AB, is the potentiometer wire and G is a galvanometer. Which of the following are the essential condition for balance to be obtained
(a) The emf of E_1 must be greater than the emf of E_2
(b) Either the positive terminals of both E_1 and E_2 or the negative terminals of both E_1 and E_2 must be joined to one end of potentiometer wire
(c) The positive terminals of E_1 and E_2 must be joined to one end of potentiometer wire
(d) The resistance of G must be less than the resistance of AB

Q 6. In a potentiometer wire experiment the emf of a battery in the primary circuit is 20 V and its internal resistance is 5Ω. There is a resistance box in series with the battery and the potentiometer wire, whose resistance can be varied from 120Ω to 170Ω. Resistance of the

potentiometer wire is 75Ω. The following potential difference can be measured using this potentiometer
(a) 5V (b) 6V (c) 7V (d) 8 V

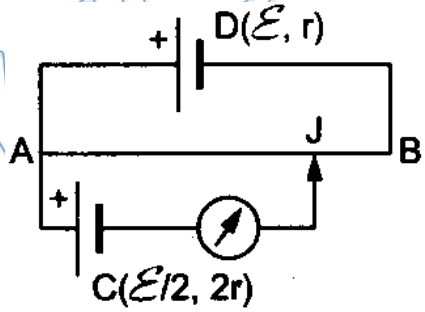
Q 7. An ammeter and a voltmeter are joined in series to a cell. Their readings are A and V respectively. If a resistance is now joined in parallel with the voltmeter,
(a) both A and V will increase
(b) both A and V will decrease
(c) A will decrease, V will increase
(d) A will increase, V will decrease

Q 8. Three ammeters A, B and C of resistances R_A, R_B and R_C respectively are joined as shown. When some potential difference is applied across the terminals T_1 and T_2, their readings are I_A, I_B and I_C respectively.



(a) $I_A = I_B$
(b) $I_AR_A + I_BR_B = I_CR_C$
(c) $\frac{I_A}{I_C} = \frac{R_C}{R_A}$
(d) $\frac{I_B}{I_C} = \frac{R_C}{R_A+R_B}$

Q 9. In the potentiometer arrangement shown, the driving cell D has emf ξ and internal resistance r. The cell C, whose emf is to be measured, has emf ξ/2 and internal resistance 2r. The potentiometer wire is 100-cm long. If balance is obtained, the length AJ = *l*.



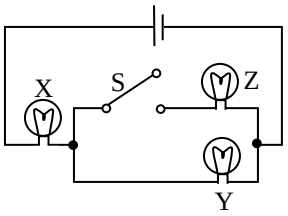
(a) l = 50 cm.
(b) l > 50 cm.
(c) Balance will be obtained only if resistance of AB is > r.
(d) Balance cannot be obtained.

Q 10. Two heaters designed for the same voltage V have different power ratings. When connected individually across a source of voltage V, they produce H amount of heat each in times t_1 and t_2 respectively. When used together across the same source, they produce H amount of heat in time t.
(a) If they are in series, $t = t_1 + t_2$.
(b) If they are in series, $t = 2(t_1 + t_2)$.

(c) If they are in parallel, t = $\frac{t_1 t_2}{(t_1+t_2)}$.

(d) If they are in parallel, t = $\frac{t_1 t_2}{2(t_1+t_2)}$

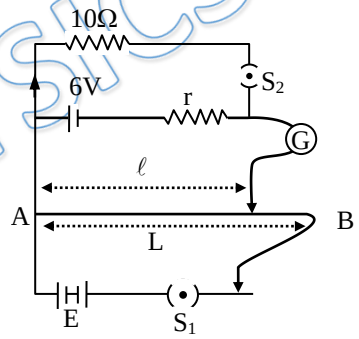
Q 11. If X, Y, and Z in figure are identical lamps, which of the following changes to the brightnesses of the lamps occur when switch S is closed?



(a) X stays the same, Y decreases
(b) X increases, Y decreases
(c) X increases, Y stays the same
(d) X decreases, Y increases

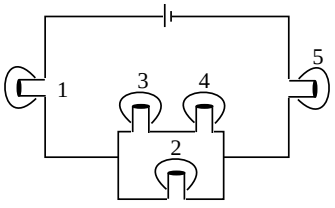
Q 12. When a galvanometer is shunted with a 4ohm resistance, the deflection is reduced to one-fifth. If the galvanometer is further shunted with a 2ohm wire, the deflection will be (The main current remains the same) -
(a) (8/13) of the original deflection only
(b) (5/13) of the original deflection
(c) (3/4) of the deflection when shunted with 4 ohm only
(d) (5/13) of the deflection when shunted with 4 ohm only

Q 13. In the arrangement shown in figure when the switch S2 is open, the galvanometer shows no deflection for l = L/2. When the switch S2 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-



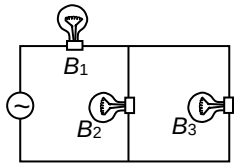
(a) 3Ω, 8V
(b) 2 Ω, 12V
(c) 2 Ω, 24V
(d) 3 Ω, 12V

Q 14. In the fig below the bulbs are identical, which bulb(s), light(s) most brightly ?



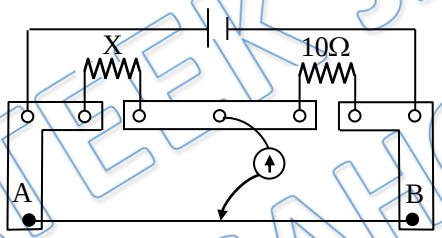
(a) 1 only (b) 4 only (c) 2 and 3 (d) 1 and 5

Q 15. Three bulbs B_1, B_2 and B_3 are connected to the mains as shown in figure. How will the incandescence of the bulb B_1 be affected, if one of the bulbs B_2 or B_3 is disconnected from the circuit?



(a) no change in the incandescence
(b) bulb B_1 will become brighter
(c) bulb B_1 will become less brighter
(d) the bulb B_1 may become brighter or dimmer depending upon wattage of the bulb which is disconnected.

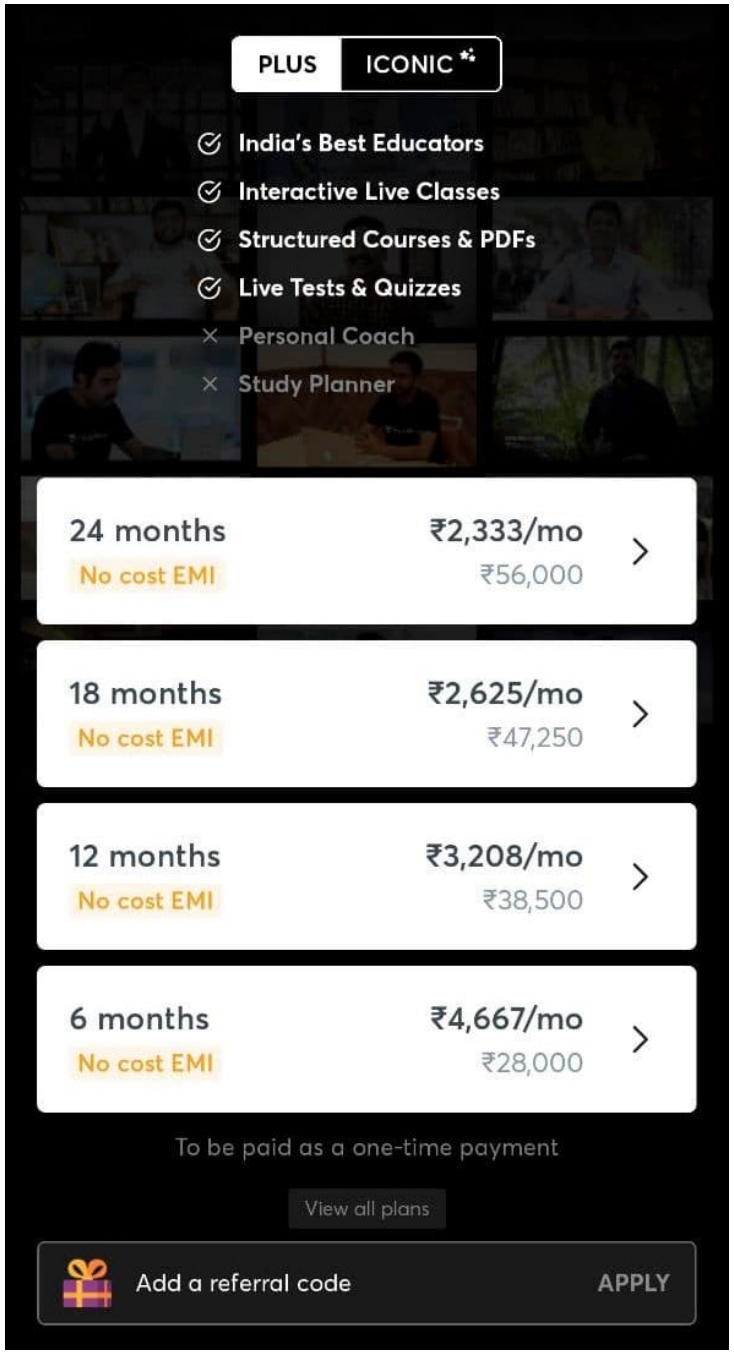
Q 16. A meter bridge is set-up as shown, to determine an unknown resistance 'X' using a standard 10 ohm resistor. The galvanometer show null point when tapping-key is at 52 cm mark. The end-corrections are 1 cm and 2 cm respectively for the ends A and B. The determine value of 'X' is-



(a) 10.2 ohm (b) 10.6 ohm
(c) 10.8 ohm (d) 11.1 ohm

Answer Key

Q.1 d	Q.2 c	Q.3 d	Q.4 b	Q.5 a, b
Q.6 a, b, c	Q.7 d	Q.8 a, b, d	Q.9 b, c	Q.10 a, c
Q.11 b	Q.12 d	Q.13 b	Q.14 d	Q.15 c
Q.16 b				



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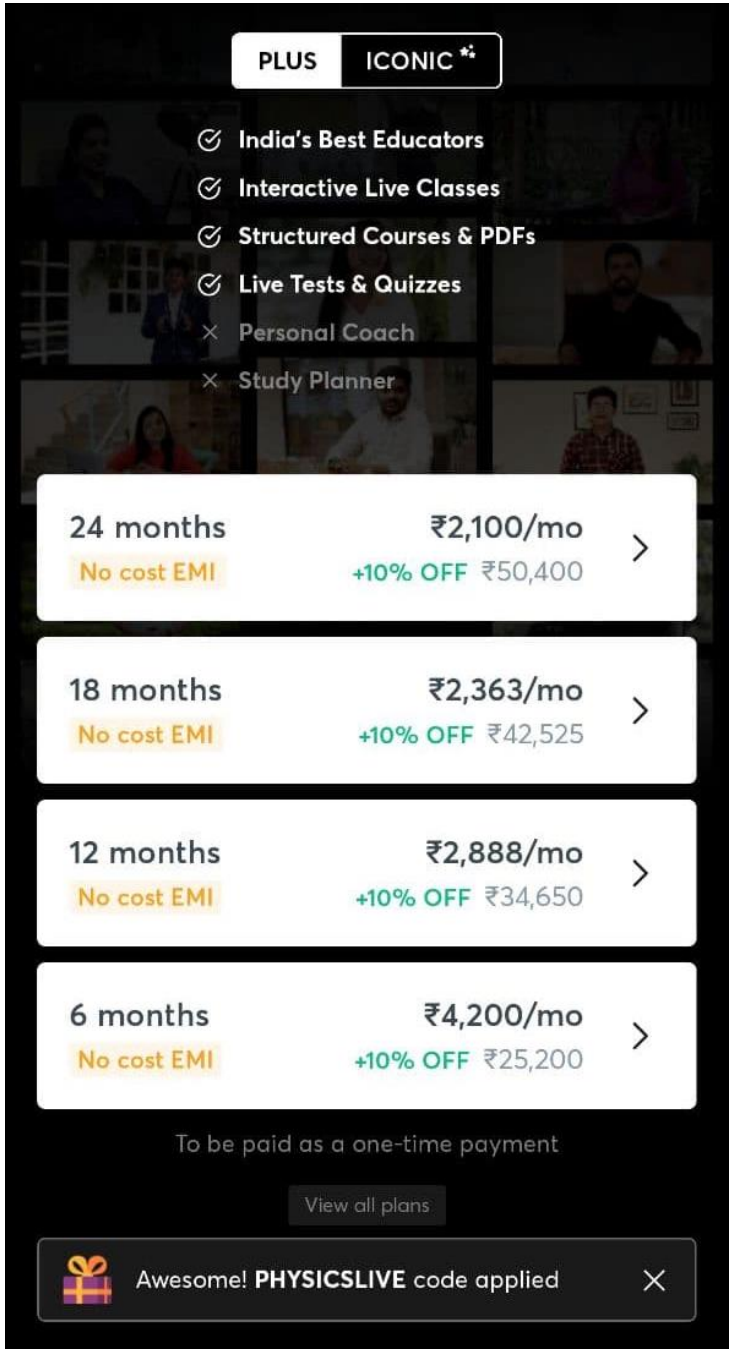
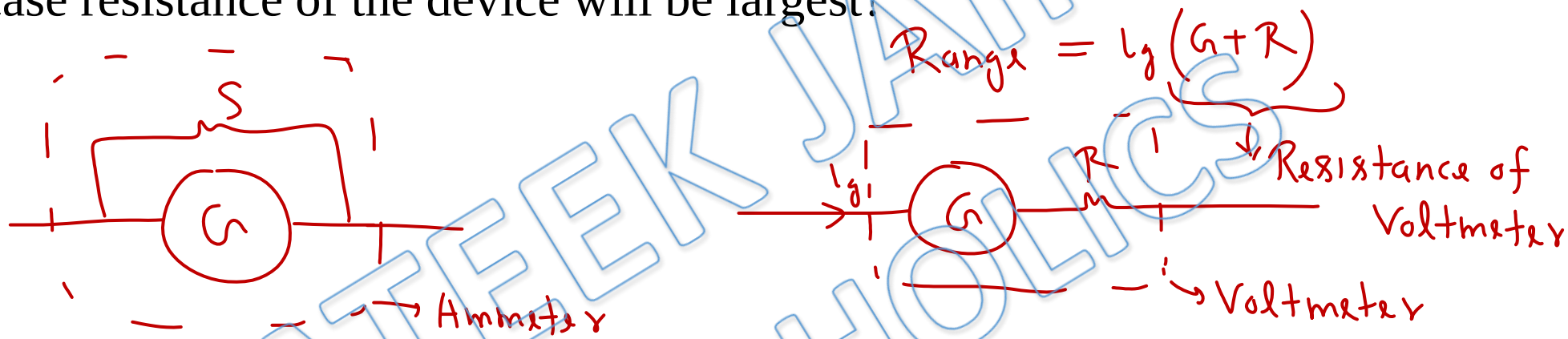


Written Solution

DPP- 7 Current :Electrical Instruments

By Physicsaholics Team

Q.1) If following meters are prepared with help of identical galvanometer. In which of the case resistance of the device will be largest?



(a)An ammeter of range 10 A

(b)A voltmeter of range 5 V

(c)An ammeter of range 5 A

(d)A voltmeter of range 10 V

$R = \frac{V_0^2}{P_0} = \frac{200 \times 200}{200} = 200\,\Omega$

Q.2) A bulb rated 200 W, 200 V is used at 100 V. Then the number of electrons passed through bulb in one second is

$i = \frac{V}{R} = \frac{100}{200} = 5^{-}\,A$

$n = \frac{5^{-}}{1.6 \times 10^{-19}}$

$= \frac{5^{-} \times 10^{18}}{1.6}$

$= 3.125 \times 10^{18}$

(a) 3.125×10^{17}

(b) Zero

(c) 3.125×10^{18}

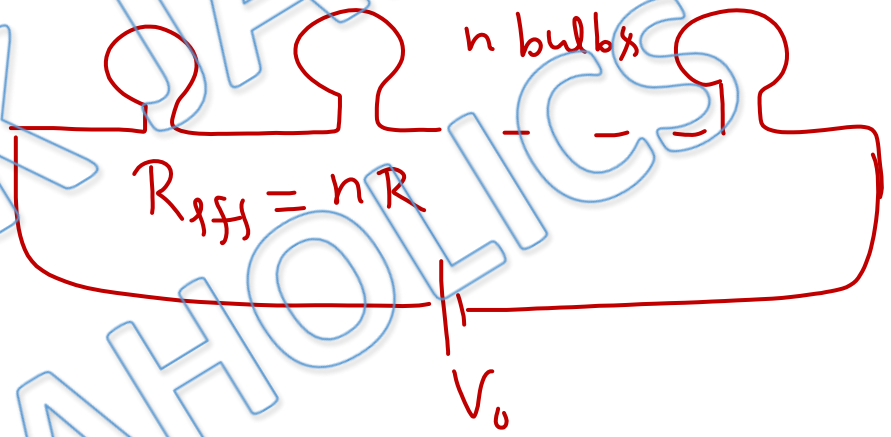
(d) 6.25×10^{18}

Q.3) ' n' identical light bulbs, each designed to draw power of P watts from a certain voltage supply are joined in series and that combination is connected across that supply. The power consumed by one bulb (in watts) will be

R

V_0

$R = \frac{V_0^2}{P}$ ---(1)



Power of Combination

$= \frac{V_0^2}{nR} = \frac{P}{n}$

(a) n P (b) P (c) P/n (d) P/n^2

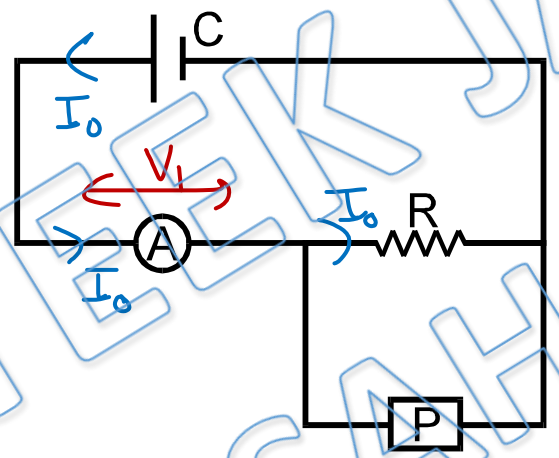
Power Consumed by one bulb of given Combination

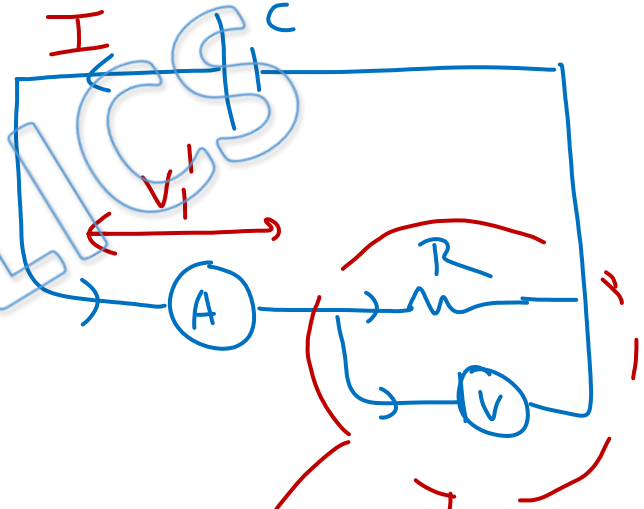
$= (P/n)/n = P/n^2$

$\frac{1}{P_{eff}} = \frac{1}{P_1} + \frac{1}{P_2} + \cdots$

$P_{eff} = P/n$

Q.4) An ammeter A of finite resistance and a resistor R are joined in series to an ideal cell C. A potentiometer P is joined in parallel to R. The ammeter reading is I_0 & the potentiometer reading is V_0. P is now replaced by a voltmeter of finite resistance. The ammeter reading now is I and the voltmeter reading is V.





(a) $I > I_0$, $V > V_0$

(b) $I > I_0$, $V < V_0$

(c) $I = I_0$, $V < V_0$

(d) $I < I_0$, $V = V_0$.

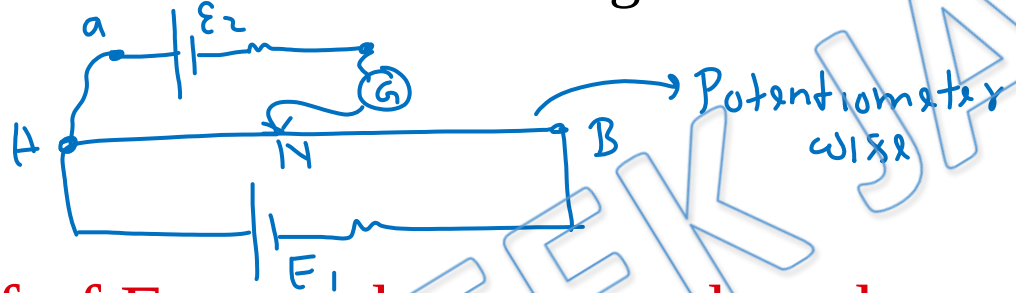
Parallel.

Effective Resistance $< R$

$I > I_0$ (Since R_{total} decreased)

$V_1' > V_1$ (Since $I > I_0$) $\Rightarrow V < V_0$

Q.5) In a potentiometer arrangement E_1 is the cell establishing current in primary circuit E_2 is the cell to be measured AB, is the potentiometer wire and G is a galvanometer. Which of the following are the essential condition for balance to be obtained



$AN \leq AB$

$\mathcal{E}_2 = V_{AN} \leq V_{AB} < E_1$

$\mathcal{E}_2 < \mathcal{E}_1$

(a) The emf of E_1 must be greater than the emf of E_2

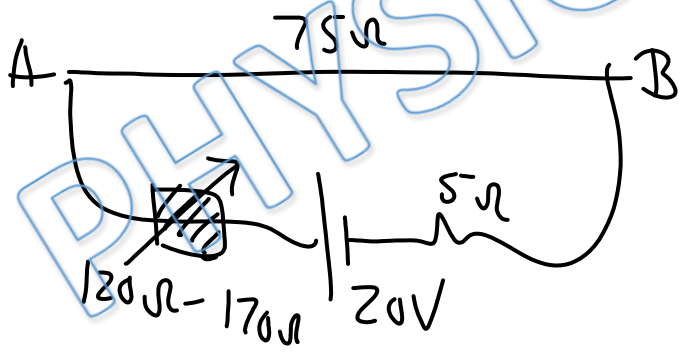
(b) Either the positive terminals of both E_1 and E_2 or the negative terminals of both E_1 and E_2 must be joined to one end of potentiometer wire

(c) The positive terminals of E_1 and E_2 must be joined to one end of potentiometer wire

(d) The resistance of G must be less than the resistance of AB

Q.6) In a potentiometer wire experiment the emf of a battery in the primary circuit is 20 V and its internal resistance is 5Ω. There is a resistance box in series with the battery and the potentiometer wire, whose resistance can be varied from 120Ω to 170Ω. Resistance of the potentiometer wire is 75Ω. The following potential difference can be measured using this potentiometer

(a) 5V (b) 6V (c) 7V (d) 8 V



0 to V_{AB} is range of Potentiometer

for max value of V_{AB} use min resistance of resistance box.

$i = \frac{20}{200} = .1A.$

$V_{AB} = .1 \times 75 = 7.5V$

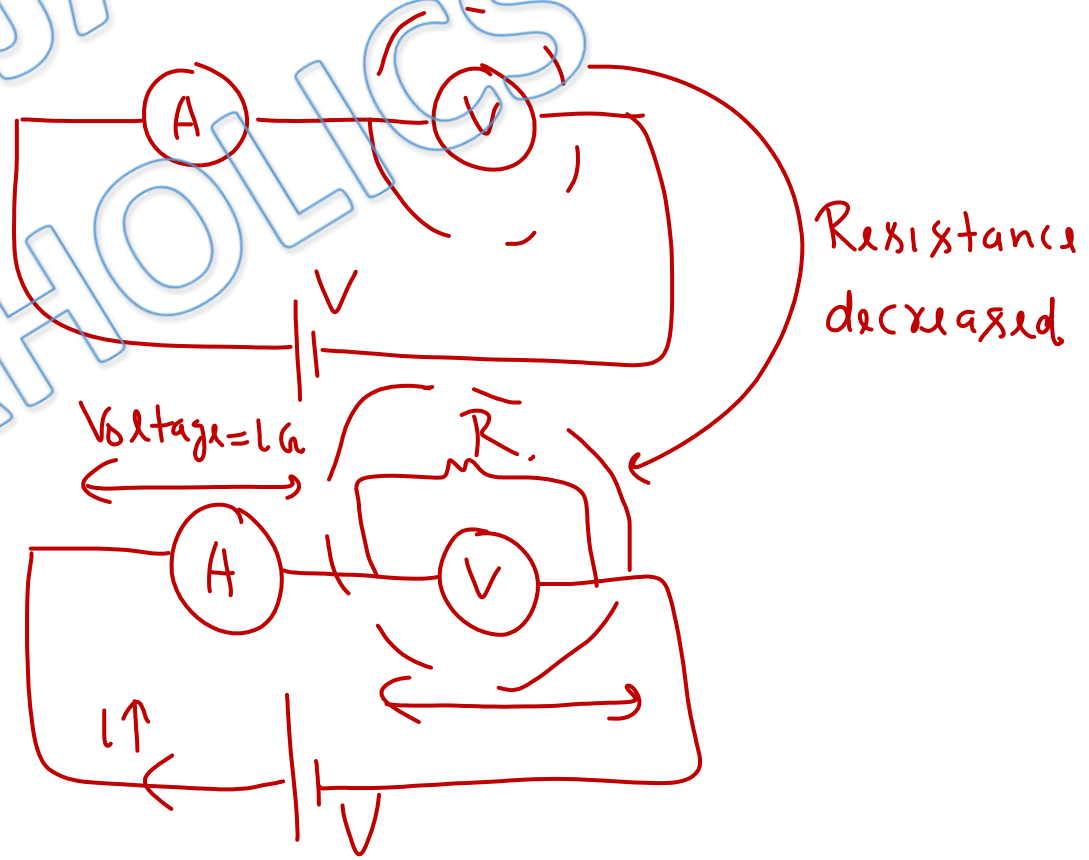
Q.7) An ammeter and a voltmeter are joined in series to a cell. Their readings are A and V respectively. If a resistance is now joined in parallel with the voltmeter,

(a) both A and V will increase

(b) both A and V will decrease

(c) A will decrease, V will increase

(d) A will increase, V will decrease



Voltage across (A) increased

" (V) decreased

Q.8) Three ammeters A, B and C of resistances R_A, R_B and R_C respectively are joined as shown. When some potential difference is applied across the terminals T_1 and T_2, their readings are I_A, I_B and I_C respectively.

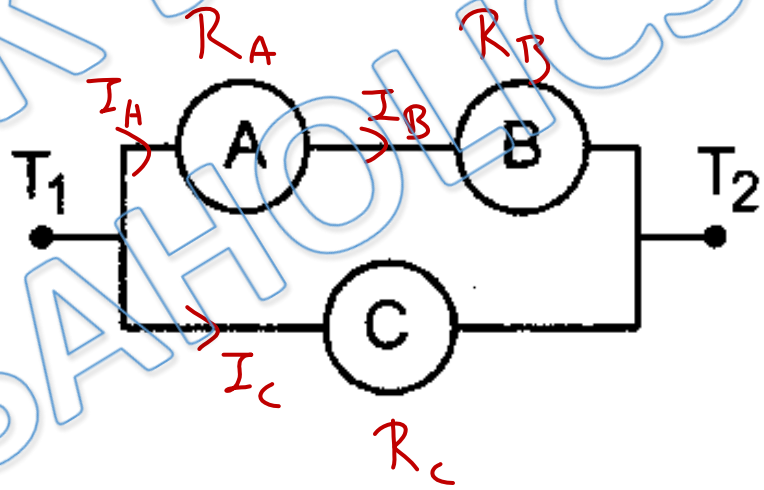
$I_A = I_B$ Since A & B are in series

(a) $I_A = I_B$

(b) $I_A R_A + I_B R_B = I_C R_C$

(c) $\frac{I_A}{I_C} = \frac{R_C}{R_A}$

(d) $\frac{I_B}{I_C} = \frac{R_C}{R_A + R_B}$



$V_A + V_B = V_C$

$I_A R_A + I_B R_B = I_C R_C$

$I_B (R_A + R_B) = I_C R_C$ ⟵ $\frac{I_B}{I_C} = \frac{R_C}{R_A + R_B}$

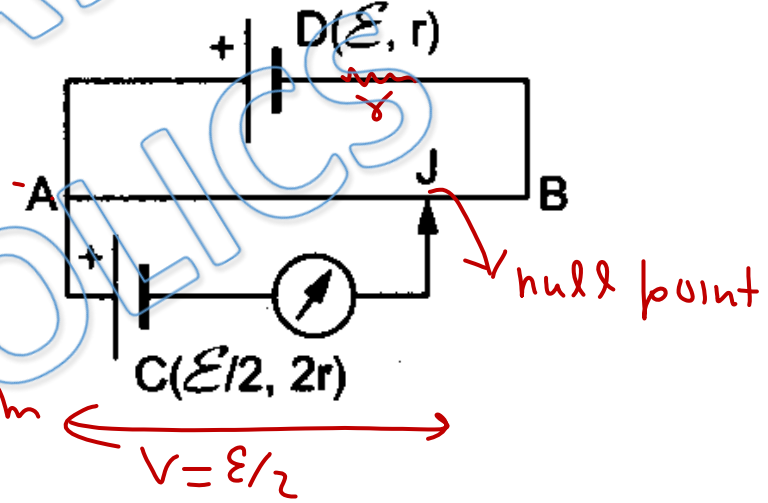
Q.9) In the potentiometer arrangement shown, the driving cell D has emf ξ and internal resistance r. The cell C, whose emf is to be measured, has emf $\xi/2$ and internal resistance 2r. The potentiometer wire is 100-cm long. If balance is obtained, the length AJ = l.

At ballance point

$R_{AJ} = R_{JB} + r$

$R_{AJ} > R_{JB}$

length AJ > JB $\Rightarrow l >$ 50 cm

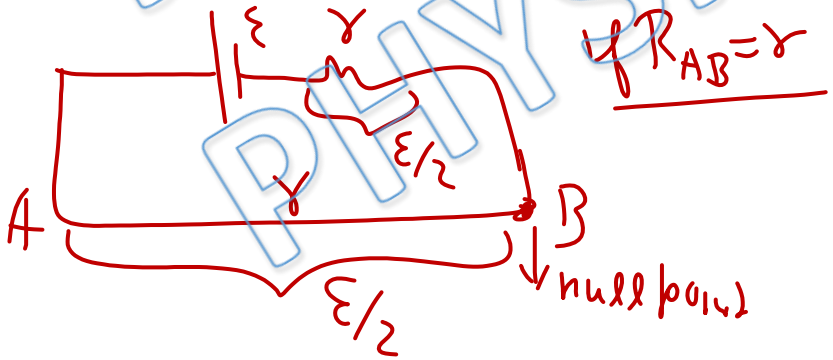


(a) l = 50 cm.

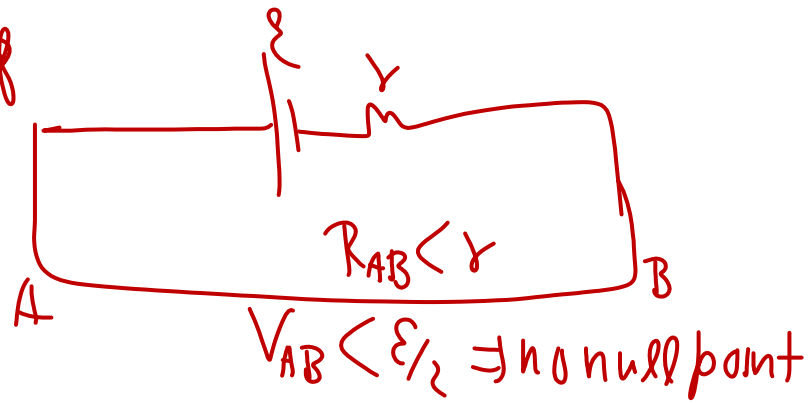
(b) l > 50 cm.

(c) Balance will be obtained only if resistance of AB is > r.

(d) Balance cannot be obtained.



if $R_{AB} = r$



Q.10) Two heaters designed for the same voltage V have different power ratings. When connected individually across a source of voltage V, they produce H amount of heat each in times t_1 and t_2 respectively. When used together across the same source, they produce H amount of heat in time t.

P_1 & P_2

$H = P_1 t_1 = P_2 t_2$ - - (1)

If Connected in Series

Effective power $= \frac{P_1 P_2}{P_1 + P_2} \Rightarrow H = \frac{P_1 P_2}{P_1 + P_2} t$

$\frac{H}{P_1} + \frac{H}{P_2} = t$

$t = t_1 + t_2$

If Connected in Parallel

Effective power $P = P_1 + P_2$

$H = Pt = (P_1 + P_2)t$

$\frac{H}{t} = P_1 + P_2 = \frac{H}{t_1} + \frac{H}{t_2}$

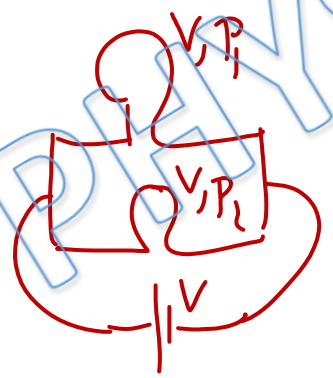
$t = \frac{t_1 t_2}{t_1 + t_2}$

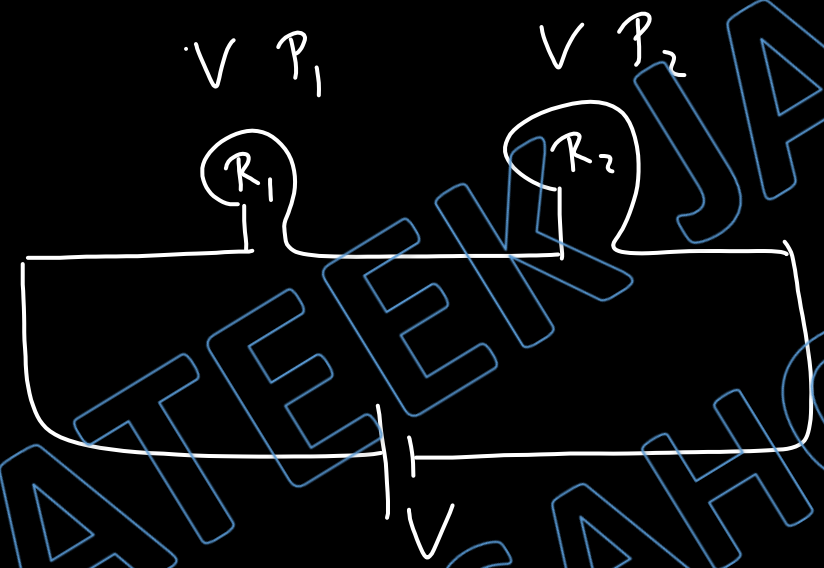
(a) If they are in series, $t = t_1 + t_2$.

(b) If they are in series, $t = 2(t_1 + t_2)$.

(c) If they are in parallel, $t = \frac{t_1 t_2}{(t_1 + t_2)}$.

(d) If they are in parallel, $t = \frac{t_1 t_2}{2(t_1 + t_2)}$





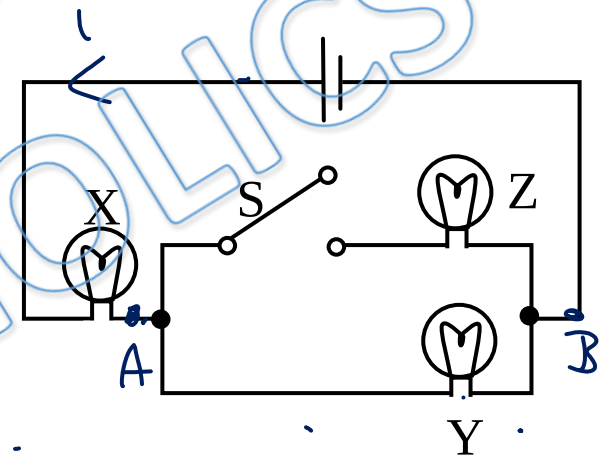
If total Power is P $\Rightarrow R_{eff} = \frac{V^2}{P}$

$R_{eff} = R_1 + R_2 = \frac{V^2}{P}$

$\frac{V^2}{P_1} + \frac{V^2}{P_2} = \frac{V^2}{P} \Rightarrow$ $P = \frac{P_1 P_2}{P_1 + P_2}$

Ans. a,c

Q.11) If X, Y, and Z in figure are identical lamps, which of the following changes to the brightnesses of the lamps occur when switch S is closed?



(a) X stays the same, Y decreases

(b) X increases, Y decreases

(c) X increases, Y stays the same

(d) X decreases, Y increases

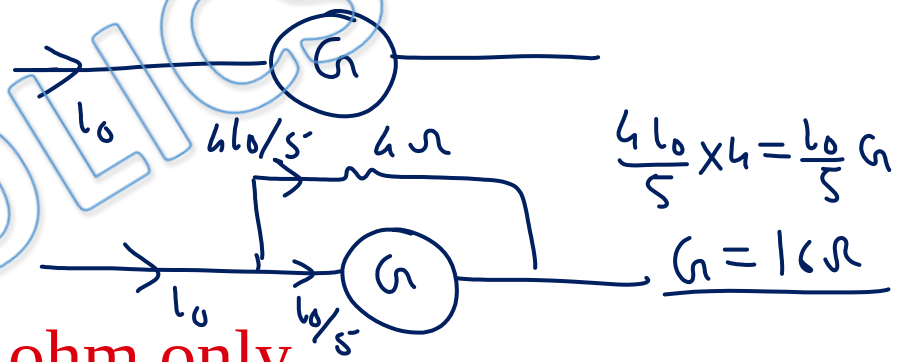
Q.12) When a galvanometer is shunted with a 4ohm resistance, the deflection is reduced to one-fifth. If the galvanometer is further shunted with a 2ohm wire, the deflection will be (The main current remains the same) -

(a) (8/13) of the original deflection only

(b) (5/13) of the original deflection

(c) (3/4) of the deflection when shunted with 4 ohm only

(d) (5/13) of the deflection when shunted with 4 ohm only



$\frac{4I_0}{5} \times 4 = \frac{I_0}{5} G$

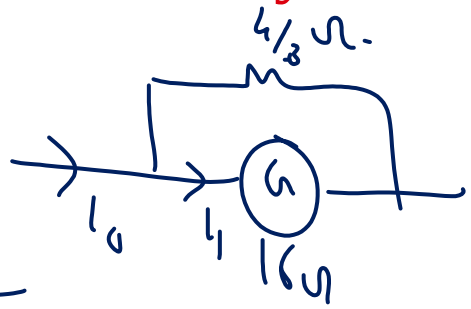
$G = 16\Omega$

$\frac{4 \times 2}{4+2} = \frac{8}{6}$

$i_1 = \frac{4/3}{16+4/3} \times I_0$

$= \frac{4}{52} \times I_0 = \frac{I_0}{13}$

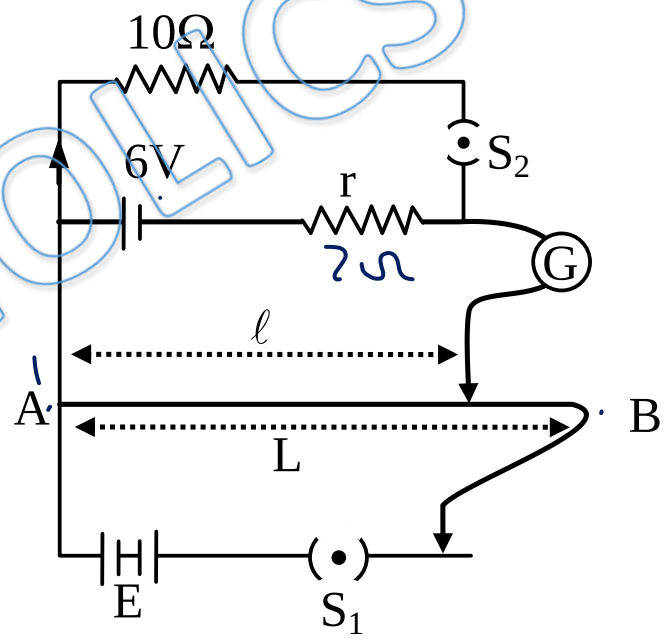
$= \left(\frac{I_0}{5}\right) \frac{5}{13}$



Q.13) In the arrangement shown in figure when the switch S2 is open, the galvanometer shows no deflection for l = L/2. When the switch S2 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-

$$\gamma = 10\left(\frac{1/2}{5/12} - 1\right)$$

$$= 10\left(\frac{6}{5} - 1\right) = 2\,\Omega$$



(a) 3Ω, 8V

(b) 2Ω, 12V

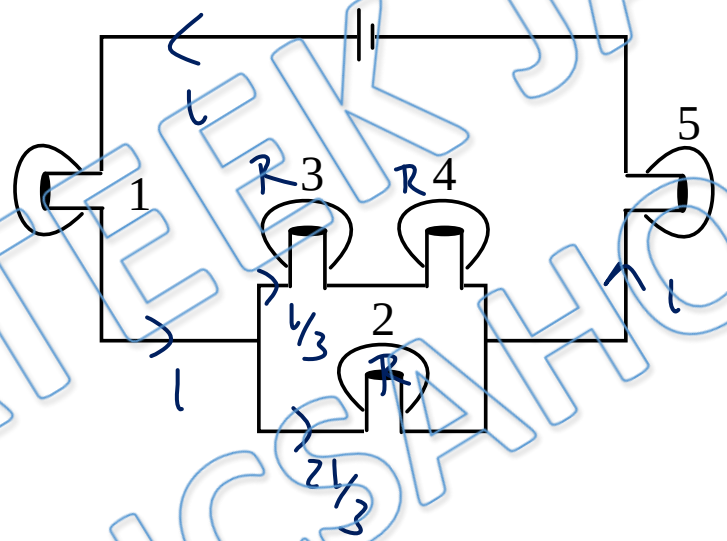
(c) 2Ω, 24V

(d) 3Ω, 12V

$\frac{L}{2}$ — 6V

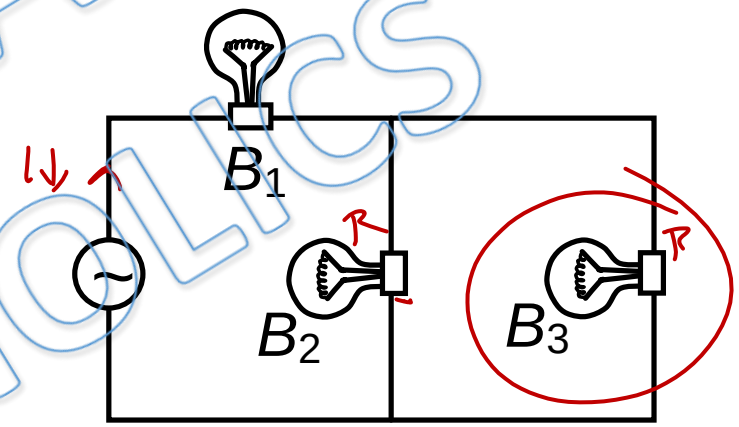
L — 12V

Q.14) In the fig below the bulbs are identical, which bulb(s), light(s) most brightly ?



(a) 1 only (b) 4 only (c) 2 and 3 (d) 1 and 5.

Q.15) Three bulbs B_1, B_2 and B_3 are connected to the mains as shown in figure. How will the incandescence of the bulb B_1 be affected, if one of the bulbs B_2 or B_3 is disconnected from the circuit?



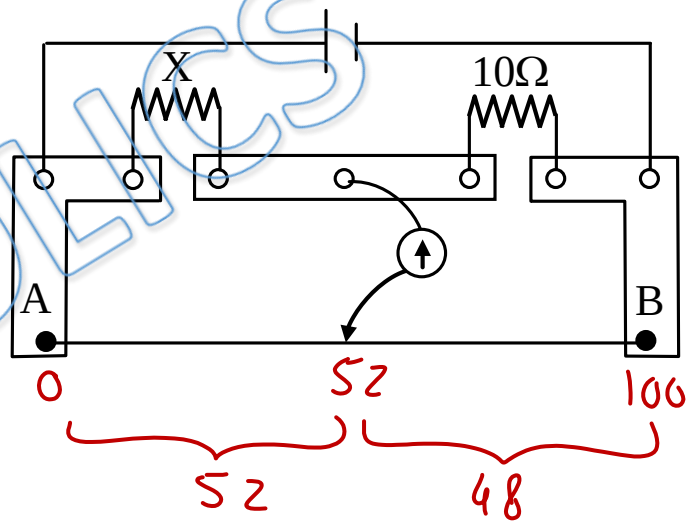
(a) no change in the incandescence

(b) bulb B_1 will become brighter

(c) bulb B_1 will become less brighter

(d) the bulb B_1 may become brighter or dimmer depending upon wattage of the bulb which is disconnected.

Q.16) A meter bridge is set-up as shown, to determine an unknown resistance 'X' using a standard 10 ohm resistor. The galvanometer show null point when tapping-key is at 52 cm mark. The end-corrections are 1 cm and 2 cm respectively for the ends A and B. The determine value of 'X' is-



(a) 10.2 ohm (b) 10.6 ohm

(c) 10.8 ohm (d) 11.1 ohm

$$\frac{X}{10} = \frac{52+1}{48+2}$$

$$X = \frac{53 \times 10}{50}$$

$$= 10.6\ \Omega$$

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