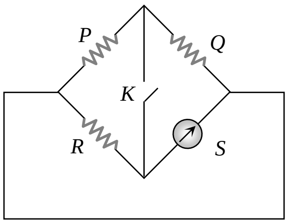
1. In a meter bridge, the balancing length from the left end (standard resistance of one *ohm* is in the right gap) is found to be 20 *cm*. The value of the unknown resistance is

(a) $0.8\,\Omega$ (b) $0.5\,\Omega$

(c) $0.4\,\Omega$ (d) $0.25\,\Omega$

2. In the following Wheatstone bridge $P/Q = R/S$. If key K is closed, then the galvanometer will show deflection

(a) In left side
(b) In right side
(c) No deflection
(d) In either side



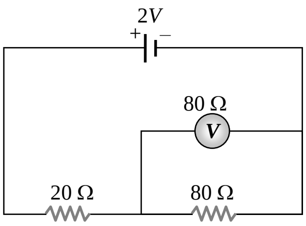
3. In a potentiometer experiment, the galvanometer shows no deflection when a cell is connected across 60 *cm* of the potentiometer wire. If the cell is shunted by a resistance of $6\,\Omega$, the balance is obtained across 50 *cm* of the wire. The internal resistance of the cell is

(a) $0.5\,\Omega$ (b) $0.6\,\Omega$

(c) $1.2\,\Omega$ (d) $1.5\,\Omega$

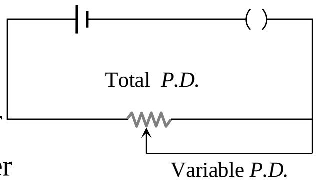
4. In the adjoining circuit, the e.m.f. of the cell is 2 *volt* and the internal resistance is negligible. The resistance of the voltmeter is 80 *ohm*. The reading of the voltmeter will be

(a) 0.80 *volt*
(b) 1.60 *volt*
(c) 1.33 *volt*
(d) 2.00 *volt*



5. The arrangement as shown in figure is called as

(a) Potential divider
(b) Potential adder
(c) Potential substracter
(d) Potential multiplier



6. The resistance of a galvanometer coil is R. What is the shunt resistance required to convert it into an ammeter of range 4 times

(a) $\frac{R}{5}$ (b) $\frac{R}{4}$

(c) $\frac{R}{3}$ (d) $4R$

7. A galvanometer with a resistance of 12 Ω gives full scale deflection when a current of 3 *mA* is passed. It is required to convert it into a voltmeter which can read up to 18 *V*. the resistance to be connected is

(a) 6000 Ω (b) 5988 Ω

(c) 5000 Ω (d) 4988 Ω

8. A galvanometer has a resistance of 25 *ohm* and a maximum of 0.01 *A* current can be passed through it. In order to change it into an ammeter of range 10 *A*, the shunt resistance required is

(a) 5/999 *ohm* (b) 10/999 *ohm*

(c) 20/999 *ohm* (d) 25/999 *ohm*

9. A potentiometer having the potential gradient of 2 *mV/cm* is used to measure the difference of potential across a resistance of 10 *ohm*. If a length of 50 *cm* of the potentiometer wire is required to get the null point, the current passing through the 10 *ohm* resistor is (in *mA*)

(a) 1 (b) 2

(c) 5 (d) 10

10. In a potentiometer experiment two cells of e.m.f. E_1 and E_2 are used in series and in conjunction and the balancing length is found to be 58 *cm* of the wire. If the polarity of E_2 is reversed, then the balancing length becomes 29 *cm*. The ratio $\frac{E_1}{E_2}$ of the e.m.f. of the two cells is

(a) 1 : 1 (b) 2 : 1

(c) 3 : 1 (d) 4 : 1

11. A 36 Ω galvanometer is shunted by resistance of 4Ω. The percentage of the total current, which passes through the galvanometer is

(a) 8 % (b) 9 %

(c) 10 % (d) 91 %

12. There are three voltmeters of the same range but of resistances 10000 Ω, 8000 Ω and 4000 Ω respectively. The best voltmeter among these is the one whose resistance is

(a) 10000 Ω (b) 8000 Ω

(c) 4000 Ω (d) All are equally good

13. To convert a 800 *mV* range *milli voltmeter* of resistance 40 Ω into a galvanometer of 100 *mA* range, the resistance to be connected as shunt is

(a) 10 Ω (b) 20 Ω

(c) 30 Ω (d) 40 Ω

14. An ammeter of 100 Ω resistance gives full deflection for the current of 10^{-5} *amp*. Now the shunt resistance required to convert it into ammeter of 1 *amp*. range, will be

(a) 10^{-4} Ω (b) 10^{-5} Ω

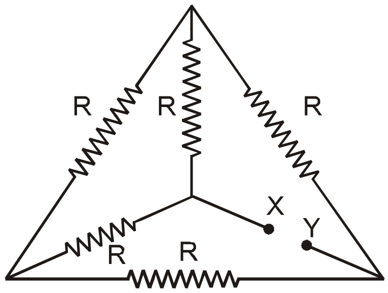
(c) 10^{-3} Ω (d) 10^{-1} Ω

15. 40W, 100W and 200 W bulbs are connected with a source of 200 V ratings of all bulbs are also 200V. Now, they are connected in series, then which bulbs will glow more :

(a) 300 W (b) 100W

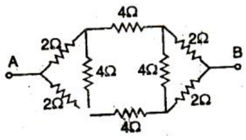
(c) 40W (d) all gives same light

16. Find equilvalent resistance between X and Y :



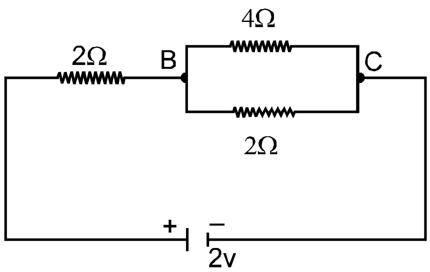
(a) R (b) R/2
(c) 2R (d) 5R

17. For the circuit of figure the equivalent resistance between points A and B is



(a) 1Ω (b) 2Ω
(c) 4 Ω (d) 8 Ω

18. The potential difference across BC in the following figure will be :



(a) 1.2 v (b) 2 v
(c) 0.8 v (d) 1 v

19. Three resistance P, Q, R each of 2Ω and an unknown resistane S form the four arms of a Wheatstone's bridge circuit. When a resistane of 6 Ω is connected in parallel to S the bridge gets balanced. What is the value of S ?

(a) 2 Ω (b) 3 Ω
(c) 6 Ω ` (d) 1 Ω

20. Two metal wired having conductivities σ_1 and σ_2 respectively have same dimensions. If they are connected in series the effective conductivity of the combination is

(a) $\frac{\sigma_1+\sigma_2}{2}$ (b) $\frac{\sigma_1-\sigma_2}{2}$
(c) $\frac{\sigma_1+\sigma_2}{\sigma_1\sigma_2}$ (d) $\frac{2\sigma_1\sigma_2}{\sigma_1+\sigma_2}$

21. An electric current is passed through a circuit containing two wires of the same material, connected in parallel. If the lengths and radii of the wires are in the ratio of 4/3 and 2/3, then the ratio of the currents passing through the wire will be :

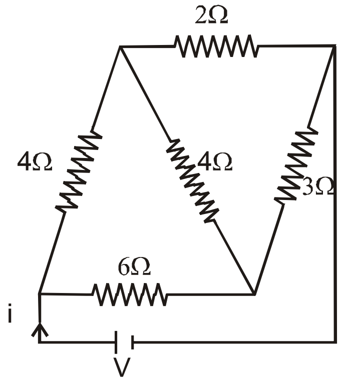
(a) 3 (b) 1/3
(c) 8/9 (d) 2

22. In a Wheatstone's bridge all the four arms have equal resistance R. If the resistance of the galvanometer arm is also R, the equivalent resistance of the combination as seen by the battery is :

(a) R (b) 2R

(c) $\frac{R}{4}$ (d) $\frac{R}{2}$

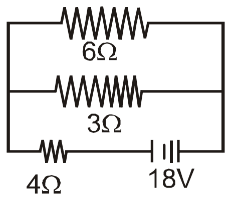
23. For the network shown in the figure, the value of the current i is :



(a) $\frac{9V}{35}$ (b) $\frac{5V}{18}$

(c) $\frac{5V}{9}$ (d) $\frac{18V}{5}$

24. The total power dissipated in watts in the circuit shown here is :-



(a) 4W (b) 16W

(c) 40W (d) 54W

25. Two nonideal batteries are connected in parallel. Consider the following statements

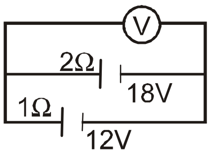
(I) The equivalent emf is smaller than either of the two emfs.

(II) The equivalent internal resistance is smaller than either of the two internal resistance.

(a) Both I and II are correct (b) I is correct but II is wrong

(c) II is correct but I is wrong (d) Each of I and II is wrong.

26. Two batteries, one of emf 18V and internal resistance 2Ω and the other of emf 12 V and internal resistance 1Ω, are connected as shown. The voltmeter V will record a reading of :



(a) 15V (b) 30 V

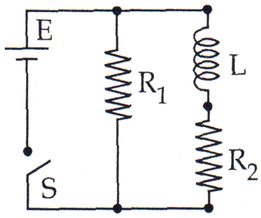
(c) 14 V (d) 18 V

27. The magnitude of momentum of electrons in a straight wire of copper of length1 meter carrying a current of 16 ampere will be

(a) 14.56×10^{-12} kg msec^{-1} (b) 29.12×10^{-12} kg m sec^{-1}

(c) 18.2×10^{-11} kg m sec^{-1} (d) 91×10^{-12} kg m sec^{-1}

28.



An inductor of inductance L = 400 mH and resistors of resistances $R_1 = 2\Omega$ and $R_2 = 2\Omega$ are connected to a battery of emf 12V as shown in the figure. The internal resistance of the battery is negligible. The switch S is closed at t = 0. The potential drop across L as a function of time is –

(a) $6\ e^{-5t}$ V (b) $\frac{12}{t}e^{-3t}V$

(c) $6\left(1-e^{-t/0.2}\right)V$ (d) $12\ e^{-5t}$ V

29. 10,000 alpha particles per minute are passing through a straight tube of radius r. The resulting electric current is approximately-

(a) 0.5×10^{-16} amp (b) 2×10^{12} amp

(c) 0.5×10^{12} amp (d) 2×10^{-12} amp

30. The length of the wire is doubled. Its conductance will -

(a) Remain unchanged (b) Be halved

(c) Be doubled (d) Be quadrupled

1. (d) $\frac{X}{1} = \frac{20}{80} \Rightarrow X = \frac{1}{4}\,\Omega = 0.25\,\Omega$.

2. (d) Pressing the key does not disturb current in all resistances as the bridge is balanced. Therefore, deflection in the galvanometer in whatever direction it was, will stay.

3. (c) $r = \frac{(l_1 - l_2)}{l_2} \times R' = \left(\frac{60-50}{50}\right) \times 6 = 1.2\,\Omega$

4. (c) Total resistance of the circuit $= \frac{80}{2} + 20 = 60\,\Omega$

$\Rightarrow$ Main current $i = \frac{2}{60} = \frac{1}{30} A$

Combination of voltmeter and 80Ω resistance is connected in series with 20Ω, so current through 20Ω and this combination will be same $= \frac{1}{30} A$.

Since the resistance of voltmeter is also 80Ω, so this current is equally distributed in 80Ω resistance and voltmeter (*i.e.* $\frac{1}{60} A$ through each)

P.D. across 80Ω resistance $= \frac{1}{60} \times 80 = 1.33\ V$

5. (a)

6. (c) $\frac{i}{i_g} = 1 + \frac{G}{S} \Rightarrow \frac{4}{1} = 1 + \frac{R}{S} \Rightarrow S = \frac{R}{3}$.

7. (b) $R = \frac{V}{i_g} - G = \frac{18}{3 \times 10^{-3}} - 12 = 5988\ \Omega$

8. (d) $i_g = i\frac{S}{G+S} \Rightarrow 0.01 = 10\frac{S}{25+S}$

$\Rightarrow 1000\,S = 25 + S \Rightarrow S = \frac{25}{999}\Omega$.

9. (d) $V = xl \Rightarrow iR = xl$

$\Rightarrow i \times 10 = \left(\frac{2 \times 10^{-3}}{10^{-2}}\right) \times 50 \times 10^{-2} = 0.1$

$\Rightarrow i = 10 \times 10^{-3} A = 10\ mA$.

10. (c) $\frac{E_1}{E_2} = \frac{l_1 + l_2}{l_1 - l_2} = \frac{58+29}{58-29} = \frac{3}{1}$

11. (c) $\frac{i_g}{i} = \frac{S}{G+S} = \frac{4}{36+4} = \frac{1}{10}$ *i.e.* 10%.

12. (a) Resistance of voltmeter should be high.

13. (a) $\frac{i}{i_g} = 1 + \frac{G}{S} \Rightarrow \frac{i.G}{V_g} = 1 + \frac{G}{S} \Rightarrow \frac{100 \times 10^{-3} \times 40}{800 \times 10^{-3}} = 1 + \frac{40}{S}$

$\Rightarrow S = 10\Omega$.

14. (c) $\frac{i}{i_g} = 1 + \frac{G}{S} \Rightarrow \frac{1}{10^{-5}} = 1 + \frac{100}{S} \Rightarrow S \approx \frac{100}{10^5} = 10^{-3}\Omega$.

15. (c) Resistance $R = \frac{V^2}{P}$

$$R \propto \frac{1}{P}$$

So, the resistance of 40 watt is maximum, heat produced $H \propto R$

$\therefore$ heat produced in 40 watt bulb will be maximum, so it will gllow more.

16. (a) The given circuit can be shown in the following way. No current will be flown in the middle resistane.

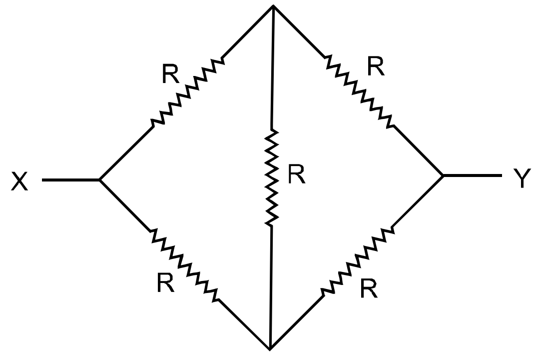
Equivalent resistance of R and R' = 2R

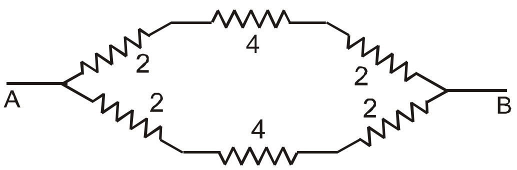
Total resistance $\frac{1}{R'} = \frac{1}{2R} + \frac{1}{2R}$

$R' = R$

Total resistance $\frac{1}{R'} = \frac{1}{2R} + \frac{1}{2R}$

$R' = R$





17. (C)

$$R_{AB} = \frac{8 \times 8}{8 + 8} = 4\Omega$$

From equipotential point

18. (c)The equivalent resistance of the circuit

$$R = \left(\frac{4 \times 2}{4 + 2}\right) + 2 = \frac{8}{6} + 2 = \frac{20}{6}$$

$$= \frac{10}{3}\Omega$$

$\therefore$ Current through the circuit

$i = \frac{V}{R} = \frac{2}{10/3} = \frac{6}{10} = \frac{3}{5}$ A

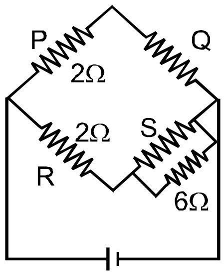
Therefore, potential difference across BC

$V = \frac{3}{5}\left(\frac{4\times 2}{4+2}\right)$ = 0.8 volt

19. (b)The bridge formed with given resistances is a balanced Wheatstone's bridge.

The situation can be depicted as shown in figure.

As resistances S and 6 Ω are in parallel their effective resistane is



$\frac{6S}{6+S}$ Ω $\qquad \frac{2}{2} = \frac{2(6+S)}{6S} \qquad$ 3S = 6 + S

S = 3 Ω

20. (d)In series $R = R_1 + R_2$

$\Rightarrow \frac{2\ell}{\sigma A} = \frac{\ell}{\sigma_1 A} + \frac{\ell}{\sigma_2 A} \qquad \Rightarrow \qquad \frac{2}{\sigma} = \frac{1}{\sigma_1} + \frac{1}{\sigma_2}$

so. $\frac{2}{\sigma} = \frac{\sigma_1 + \sigma_2}{\sigma_1 \sigma_2}$ so $\sigma = \frac{2\sigma_1 \sigma_2}{\sigma_1 + \sigma_2}$

21. (b): same

In parallel $\Rightarrow$ $i_1 R_1 = i_2 R_2$

$\Rightarrow \frac{i_1}{i_2} = \frac{R_2}{R_1} = \frac{\rho \ell_2 / A_2}{\rho \ell_1 / A_1} = \frac{\ell_2}{\ell_1} \times \frac{r_1^2}{r_2^2}$

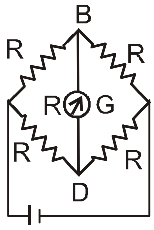
$\therefore \frac{\ell_1}{\ell_2} = \frac{4}{3}$ and $\frac{r_1}{r_2} = \frac{2}{3}$

$\Rightarrow \frac{i_1}{i_2} = \frac{1}{3}$ **Ans.**

22. (a)The balanced condition of wheat-stone's bridge is ,

$\frac{R_{AB}}{R_{BC}} = \frac{R_{AD}}{R_{DC}}$

As bridge is in balanced condition, no current will flow through BD.



$R_1 = R_{AB} + R_{BC}$

$= R + R = 2R$

$R_2 = R_{AD} + R_{CD} = R + R = 2R$

R_1 and R_2 are in parallel combination.

Hence, equivalent resistance between A and C will be.

$\therefore R_{eq} = \frac{R_1R_2}{R_1 + R_2} = \frac{4R^2}{4R} = R$

23. (b)The circuit given resembles the balanced Wheatstone Bridge as $\frac{4}{6} = \frac{2}{3}$.

Thus, middle arm containing 4Ω resistance will be ineffective and no current flows through it.

The equivalent circuit is shown as below :

Net resistance of AB and BC

$R' = 4 + 2 = 6\Omega$

Net resistance of AD and DC

$R'' = 6 + 3 = 9\Omega$

Thus, parallel combination of R′ and R″ gives

$R = \frac{R' \times R''}{R' + R''}$

$= \frac{6 \times 9}{6 + 9} = \frac{54}{15} = \frac{18}{5}\Omega$

Hence, current $i = \frac{V}{R} = \frac{V}{18/5} = \frac{5V}{18}$

24. (d)

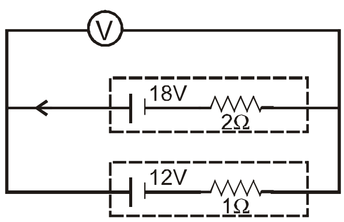
25. (c)$E_{eq} = \frac{\frac{E_1}{r_1} + \frac{E_2}{r_2}}{\frac{1}{r_1} + \frac{1}{r_2}} = \frac{E_1r_2 + E_2r_1}{r_1 + r_2}$ $r_{eq} = \frac{r_1r_2}{r_1 + r_2}$

Therefore statement II is correct bul I is wrong.

bl dkj.k dFku (II) lgh gS ,oa (I) xyr gSA

26. (c)It is clear that the two cells oppose each other hence, the effective emf in closed circuit is 18 – 12 = 6V and net resistance is 1 + 2 = 3Ω (because in the closed circuit the internal resistances of two cells are in series).

The current in circuit will be in direction of arrow shown in figure.



$I = \frac{\text{effective emf}}{\text{total resistance}} = \frac{6}{3} = 2A$

The potential difference across V will be same as the terminal voltage of either cell.

Since, current is drawn from the cell of 18 volt, hence,

$V_1 = E_1 - ir_1$

$= 18 - (2 \times 2) = 18 - 4 = 14$ V

Similarly, current enters in the cell of 12V hence

$V_2 = E_2 + ir_2$

$= 12 + 2 \times 1$

$= 12 + 2 = 14$ V

Hence, V = 14V

27. (d)

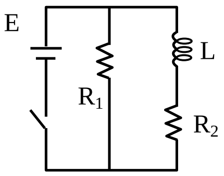
If n is the number of electrons per unit volume, then total number of free electrons = nLA

Hence total mass of the electrons = nLA m_e

Total momentum of electrons = nLA $m_e \times v_d$ = nLA $m_e \times \frac{I}{e}$

$= \frac{1\times 9.1\times 10^{-31}\times 16}{1.6\times 10^{-19}} = 91\times 10^{-12}$ kg- sec^{-1}, Hence correct answer is

28. (d)



$I = I_0 (1 - e^{-t/\tau})$ ($\tau = L/R^2$)

$\varepsilon = \frac{LdI}{dt} = \frac{+LI_0e^{-t/\tau}}{\tau}$

$\varepsilon = \frac{E_0\times L}{R\times L/R}\ e^{-t/\tau}$

$\varepsilon = E_0\, e^{-t/\tau}$

$\varepsilon = 12e^{-5t}$

So option (4) is correct

Note : Smart work : At t = 0 inductor acts as open CRt and P.D across inductor will be 12V which is possible only in option (4).

29. (a)

$i = \frac{n(2e)}{t} = \frac{10000\times 2\times 1.6\times 10^{-19}}{60}$

$= 0.5 \times 10^{-16}$ A

30. (d)

$G = \frac{1}{R} = \frac{A}{\rho\ell}$