PHYSICS

BOOKS - AAKASH SERIES

CURRENT ELECTRICITY

LECTURE SHEET (EXERCISE-I LEVEL-1(MAIN) (Straight Objective Type Questions))

1. An electron of mass m, moves around the nucleus in a circular orbit of radius .r. under the action of centripetal force .F.. The equivalent electric current is

A. $\frac{e}{2\pi}\sqrt{\frac{F}{mr}}$

B. $2\pi e\sqrt{\frac{F}{mr}}$

C. $\frac{e}{\pi}\sqrt{\frac{F}{mr}}$

D. $\frac{e}{2\pi}\sqrt{\frac{mr}{F}}$

Answer: A

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2. A copper conductor of area of cross- section 40 mm^2 on a side carries a constant current of $32 \times 10^{-6} A$. Then the current density is (in amp/m^2)

A. 1.6

B. 0.8

C. 0.4

D. 3.2

Answer: B

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3. Positive and negative ions are produced in the atmosphere due to cosmic rays from space and also due to radioactive elements in the soil. In some region in the atmosphere, the electric field strength is $100V/m$ in the vertically downward direction. This field exerts force on the positive and negative ions in the given region in atmosphere. As a result, positive ions, having a density $500 / cm^3$ drift downward while negative ions, having a density $300 / cm^3$ drift upward. All these ions are singly charged. It is observed that the conductivity in the given region is $4 \times 10^{-13} (\Omega - m)^{-1}$. Find the average speed of ions, assuming it to be the same for positive and negative ions.

A. $1.3 m / s$

B. $0.31 m / s$

C. $0.93 m / s$

D. $1.6 \, m / s$

Answer: B

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4. Electric current through a conductor varies with time as I(t) $= 50\sin(100\pi t)$. Here I is in amperes and t in seconds. Total charge that passes any point from $t = 0$ to $t = \frac{1}{200}s$ is

A. 1.2 C

B. 0.36 C

C. 0.159 C

D. 0.02 C

Answer: C

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5. A current of (2.5 ± 0.05) A flows through a wire and develops a potential difference of (10 ± 0.07) volt. Resistance of the wire in ohm, is

A. 4 ± 0.108

B. 4 ± 0.04

C. 4 ± 0.1104

D. 4 ± 0.02

Answer: C

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6. The current in a conductor varies with time .t. as $I = 3t + 4t^2$. Where I in amp and t in sec. The electric charge flows through the section of the conductor between t = 1s and t = 3s

A. $\frac{14}{3}$ C

B. $\frac{3}{14}$ C

C. $\frac{140}{3}$ C

D. $\frac{3}{140}$ C

Answer: C

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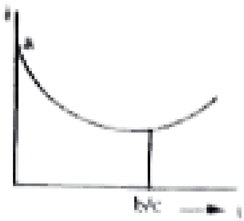
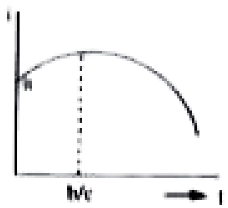
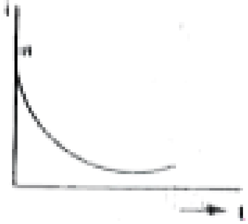
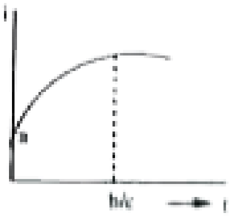
LECTURE SHEET (EXERCISE-I LEVEL- II (ADVANCED) (Straight Objective Type Questions))

1. The charge flowing in a conductor varies with time as $Q = at - \frac{1}{2}bt^2 + \frac{1}{6}ct^3$ where a, b and c are positive constants. If at time t, the current in the conductor is i, which of the following graphs is correct ?

A. 

B. 

C. 

D. 

Answer: A

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2. Potential difference that is applied across a conductor of resistance .R. varies with time .t. according to the equation $V(t) = V_0 e^{-t/z}$ where z is a constant that has dimonsions of time. Obviously, the

applied potential difference decreases exponentially with time. Charge that passes through any fixed observation point within the conductor between t=0 and t=z will be

A. $\frac{V_0}{R}$

B. $0.368\frac{V_0}{R}$

C. $0.632\frac{V_0 z}{R}$

D. $0.368\frac{V_0 z}{R}$

Answer: C

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

A. 3

B. 2

C. $8/9$

D. $1/3$

Answer: D

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4. Two wires of the same material have length 6cm and 10cm and radii 0.5 mm and 1.5 mm respectively. They are connected in series across a battery of 16 V. The p.d. across the shorter wire is

A. 5V

B. 13.5 V

C. 27 V

D. 10 V

Answer: B

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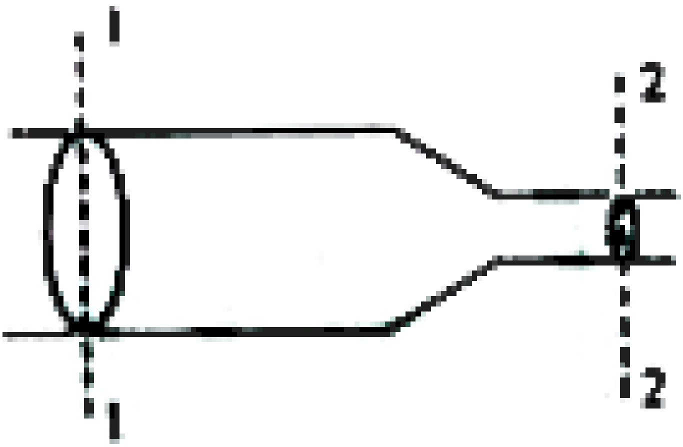
LECTURE SHEET (EXERCISE-I LEVEL- II (ADVANCED) (More than one correct answer type Questions))

1. The area of cross section of a current carrying conductor is A_0 and $\frac{A_0}{4}$ at section (1) and (2) respectively. If $v_{\alpha_1}, v_{\alpha_2}$ and E_1, E_2 be the drift velocity and electric field at sections 1 and 2 respectively then :



A. $v_{\alpha_1} : v_{\alpha_2} = 1 : 4$

B. $v_{\alpha_1} : v_{\alpha_2} = 4 : 1$

C. $E_1 : E_2 = 4 : 1$

D. $E_1 : E_2 = 1 : 4$

Answer: A::D

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2. A current passes through a wire of nonuniform cross-section. Which of the following quantites are independent of the cross section?

A. the charge crossing in a given time interval

B. drift speed

C. current density

D. free- electron density

Answer: A::D

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3. Match Column - I with Column - II

COLUMN - I	COLUMN - II
A) Electrical conductivity of a conductor depends on	p) dimensions (length and area of cross-section)
B) Conductance of a conductor depends on	q) temperature
C) For a given conductor and at a given temperature, current density depends on	r) nature of conductor
D) For a given potential differtence applied across a conductor, current in it will depend on	s) electric field strength

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LECTURE SHEET (EXERCISE- II LEVEL-I (MAIN) (Straight Objective Type Questions))

1. The resistance of the wire is 121 ohm. It is divided into .n. equal parts and they are connected in parallel, then effective resistance is 1 ohm. The value of .n. is

A. 12

B. 13

C. 11

D. 3

Answer: C

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2. The resultant resistance of two resistance in series is 50 Ω and it is 12 Ω , when they are in parallel. The individual resistances are

A. $20\Omega \text{ and } 15\Omega$

B. $15\Omega \text{ and } 30\Omega$

C. $20\Omega \text{ and } 30\Omega$

D. $10\Omega \text{ and } 15\Omega$

Answer: C

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3. A conductor of resistance 3Ω is stretched uniformly till its length is doubled . The wire is now bent in the form of an equilateral triangle . The effective resistance between the ends of any side of the triangle in ohms is

A. $\frac{9}{2}\Omega$

B. $\frac{8}{3}\Omega$

C. 2Ω

D. 1Ω

Answer: B

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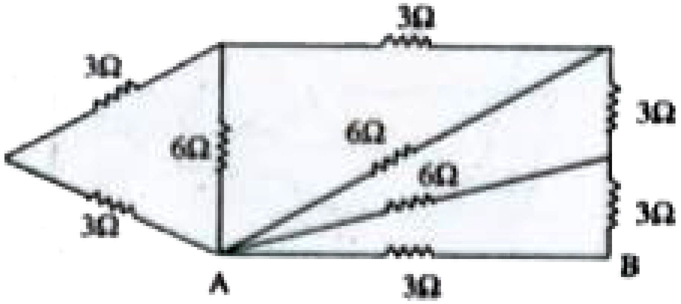
4. The effective resistance between A and B is the given circuit is



A. 2Ω

B. 3Ω

C. 9Ω

D. 6Ω

Answer: A

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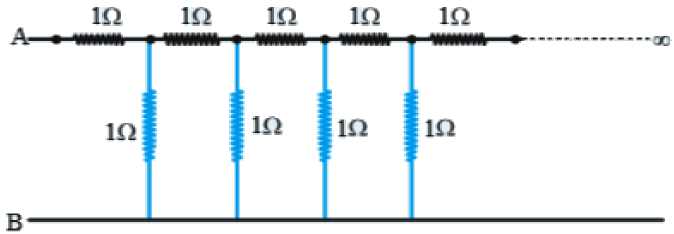
5. The equivalent resistance between points A and B of an infinite network of resistance, each of 1Ω connected as shown is`



A. inifinite

B. 2Ω

C. zero

D. $\left(\frac{1 \pm \sqrt{5}}{2}\right)$

Answer: D

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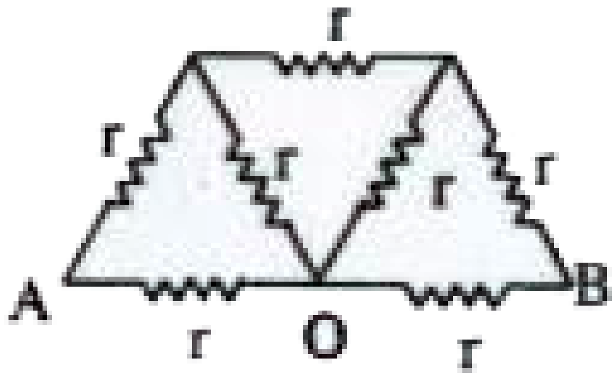
6. Equivalent resistance across A and B in the given circuit is



A. 7r

B. $8r/7$

C. $4r/7$

D. $7r/8$

Answer: B

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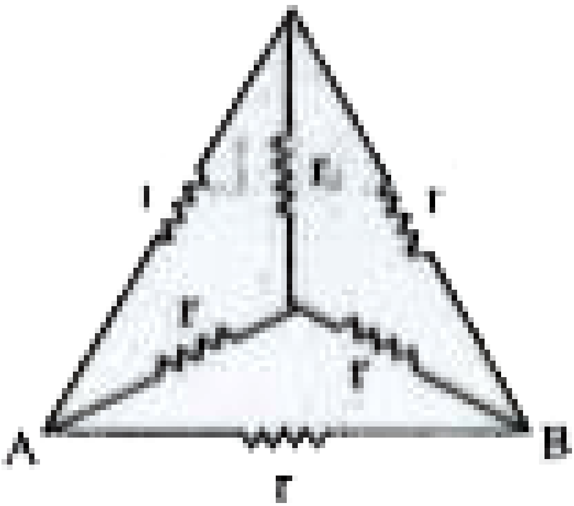
7. Effective resistance between A and B in the given circuit it is



A. 6r

B. r

C. 2r

D. $r/2$

Answer: D

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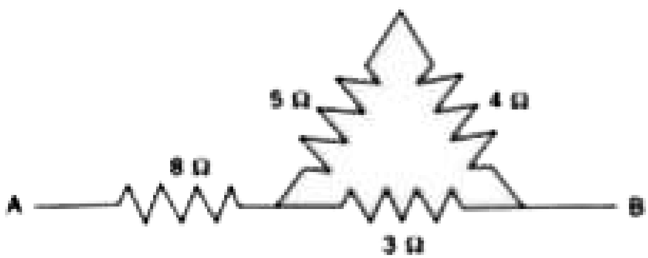
8. Calculate the effective resistance across AB :



A. r

B. 2r

C. $r/2$

D. $r/4$

Answer: C

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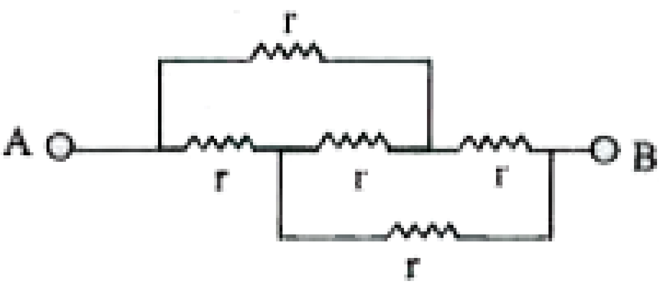
9. Effective resistance between A and B in the given circuit is



A. r

B. 3r

C. 5r

D. 4r

Answer: A

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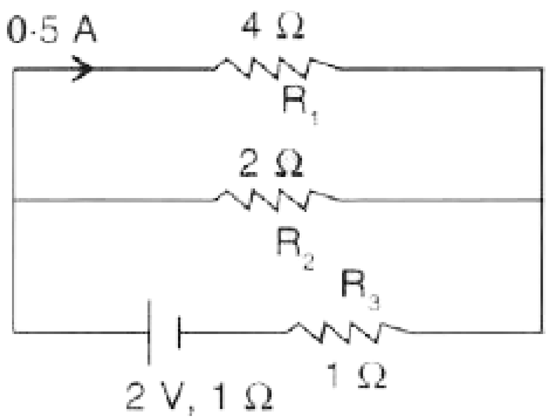
10. In an electric circuit shown alongside, find



terminal voltage of the battery

A. 4Ω

B. 2Ω

C. 3Ω

D. 1Ω

Answer: C

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11. An aluminium $\left(\alpha_{Al} = 4 \times 10^{-3} / {}^{0}C\right)$ wire resistance . R_1. and carbon wire $\left(\alpha_c = 0.5 \times 10^{-3} / {}^{0}C\right)$ resistance . R_2. are connected in series to have a resultant resistance of 18 ohm at all temperatures The values of R_1 and R_2 in ohms

A. 2, 16

B. 12, 6

C. 13, 5

D. 14, 4

Answer: A

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12. A carbon and an aluminium wire are connected in series. If the combination has resistance of 30Ω at

$30^\circ C$, what is the resistance of each wire at $0^\circ C$so that resistance of the combination does not change with temperature.

$(a_c = -0.5 \times 10^{-3} / ^\circ C, a_A = 4 \times 10^{-3} / ^\circ C)$

A. 120Ω

B. 15Ω

C. 60Ω

D. 210Ω

Answer: B

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13. The resistance of a metal wire is 10Ω. A current of 30 mA is flowing in it at 20°C. If p.d. across its ends is constant, then its temperature is increased to $120^{\circ}C$, then the current flowing in the wire will be in mA $\left(\alpha = 5 \times 10^{-3/0}C\right)$

A. 20

B. 15

C. 10

D. 40

Answer: A

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14. Two resistors with temperature coefficients of resistance α_1 and α_2 have resistances R_{01} and R_{02} at $0^\circ C$. Find the temperature coefficient of the compound resistor consisting of the two resistors connected.

a.. In series and

b. in paralllel

A. $\dfrac{R_1\alpha_1 + R_2\alpha_2}{R_1 + R_2}$

B. $\dfrac{\alpha_1 + \alpha_2}{2}$

C. $\dfrac{2\alpha_1\alpha_2}{\alpha_1 + \alpha_2}$

D. $\dfrac{R_1\alpha_2 + R_2\alpha_1}{R_1 + R_2}$

Answer: D

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LECTURE SHEET (EXERCISE- II LEVEL- II (ADVANCED) (Straight Objective Type Questions))

1. A coaxial cable is made up of two conductors. The inner conductor is solid is of radius R_1 and the outer coductor is hollow of inner radius R_2 and outer radius R_3 . The space between the conductors are carrying currents of equal magnitudes and in oppsite direactions. then the variation of magnetic field with distance form the axis is best plotted as :

A. $\dfrac{\rho}{4\pi}\dfrac{ab}{(b-a)}$

B. $\dfrac{\rho(b-a)}{4\pi ab}$

C. $\dfrac{4\pi ab}{\rho(b-a)}$

D. $\dfrac{\rho(b-a)}{2\pi ab}$

Answer: B

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2. A material of resistivity ρ is formed in the shape of a truncated cone of altitude h. The top end has a radius a while bottom b. Assuming a uniform current density through any circular cross-section of the cone. Find the resistance between the two ends.

A. $\frac{\rho}{2\pi}\frac{h}{ab}$

B. $\frac{2\rho}{\pi}\frac{h}{ab}$

C. $\frac{\rho}{\pi}\frac{h}{ab}$

D. $\frac{\rho}{\pi}\frac{h}{(a+b)}$

Answer: C

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3. The cross-section area and length of cylindrical conductor are A and l respectively. The specific conductivity varies as $\sigma(x) = \sigma_0 \frac{l}{\sqrt{x}}$, where x is the distance along the axis of the cylinder from one of its ends. Compute the resistance of the system along the cylindrical axis.

A. $\frac{3\sqrt{l}}{2A\sigma_0}$

B. $\frac{2l}{3A\sigma_0}$

C. $\frac{2\sqrt{l}}{3A\sigma_0}$

D. $\dfrac{\sqrt{l}}{A\sigma_0}$

Answer: C

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4. Potential in the x-y plane is given as $V = 5(x^2 + xy)$ volts. Find the electric field at the point (1, -2).

A. j_(0)A/3

B. $\dfrac{\sigma_0 V_0}{\sqrt{x}}, \dfrac{V_0\sqrt{x}}{2l^{3/2}}$

C. $\dfrac{2}{3}\dfrac{\sigma_0 V_0}{\sqrt{x}}, \dfrac{2}{3}\dfrac{V_0\sqrt{x}}{l^{3/2}}$

D. $\dfrac{3\sigma_0 V_0}{2\sqrt{l}}, \dfrac{3V_0\sqrt{x}}{2l^{3/2}}$

Answer: D

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5. A thin wire of length L and cross-sectional area A oriented in the x-direction is made up of an ohmic material whose resistivity varies along the wire according to the empirical law $\rho = \rho_0 e^{-x / lL}$

(i) Determine how the field with in wire varies with position if the end at x=0 is at potential V_0 greater than the end at x=L.

(ii) How does potential varies as you move along the wire ?

(Iii) What is resistance of the wire ?

A. $\frac{\rho_0 L}{A}\left(\frac{1}{e}\right)$

B. $\frac{\rho_0 L}{A}(e)$

C. $\frac{\rho_0 L}{A}\left(1-\frac{1}{e}\right)$

D. $\frac{\rho_0 L}{A}(e-1)$

Answer: C

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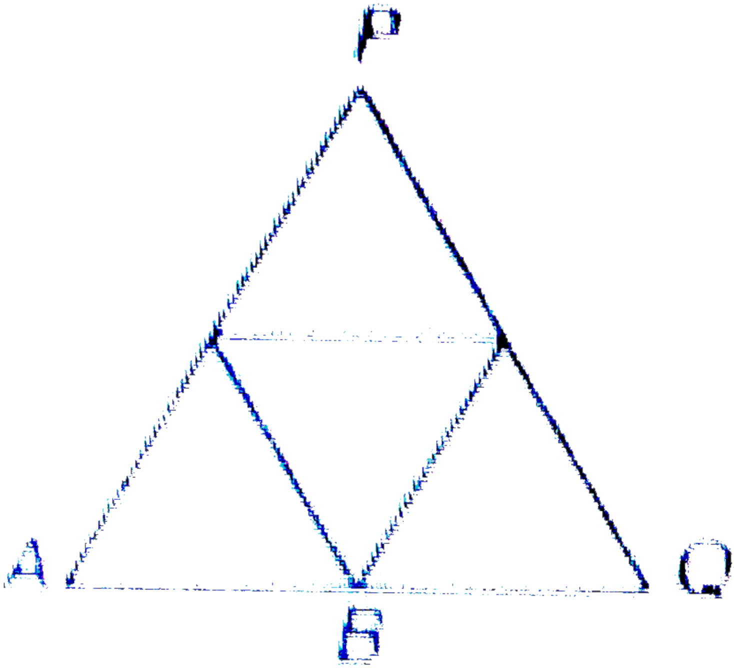
6. In the diagram, resistance between any two junction is R. Equivalent resistance acm terminas A and B is

(assume P and Q also as juction)



A. $\dfrac{11R}{7}$

B. $\dfrac{18R}{11}$

C. $\dfrac{7R}{11}$

D. $\dfrac{11R}{18}$

Answer: D

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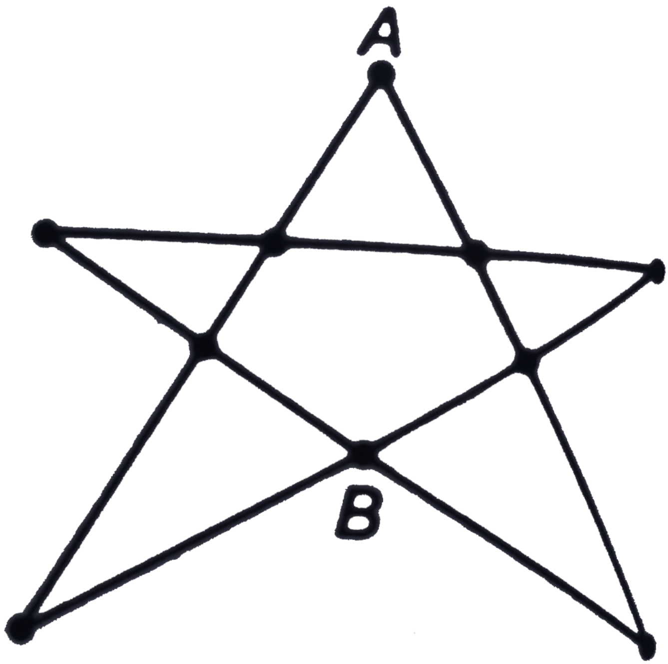
7. The resistance of all the wires between any two adjacent dots is R. Then, equivalent resistance between $A$and B as shown in figure is



A. $7 / 3R$

B. $7 / 6R$

C. $14 / 8R$

D. None of these

Answer: B

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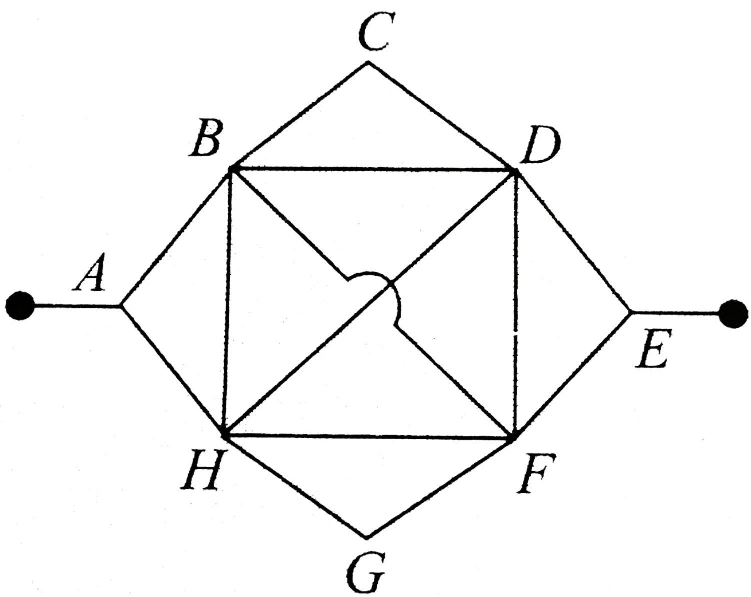
8. Identical resistor each of resistance r are connected as shown in figure. Calculate equivalent resistance between A and E.



A. $\frac{r}{2}$

B. 3r

C. 1.2 r

D. 1.5 r

Answer: C

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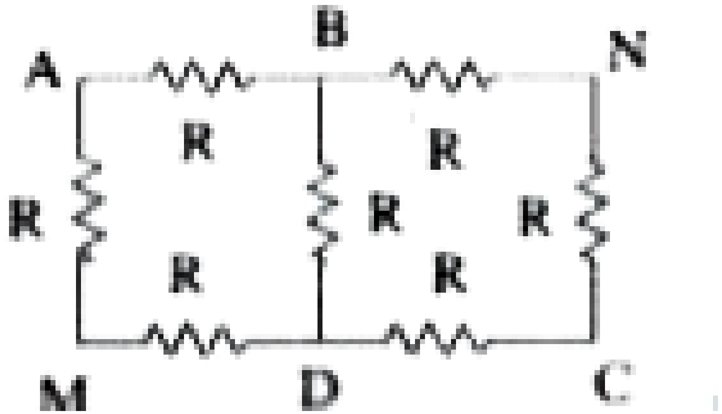
9. What is the equivalent resistance between point A and C in the circuit shown in fig. ?



A. $\frac{4R}{3}$

B. $\frac{11R}{15}$

C. 2R

D. $\frac{7R}{5}$

Answer: D

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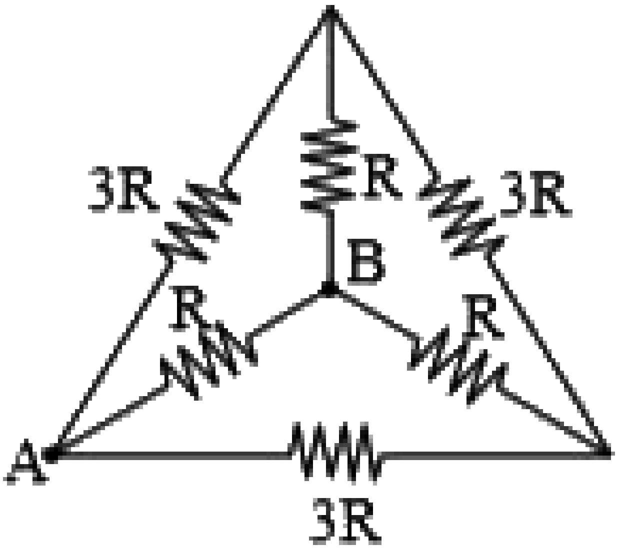
10. Six resistances are connected as shown here. The effective resistance between points A and B is -



A. $\frac{18}{11}\Omega, \frac{621}{550}\Omega, \frac{12}{11}\Omega$

B. $\frac{18}{11}\Omega, \frac{441}{550}\Omega, \frac{621}{550}\Omega$

C. $\frac{36}{11}\Omega, \frac{25}{630}\Omega, \frac{13}{11}\Omega$

D. $\frac{9}{11}\Omega, \frac{22}{55}\Omega, \frac{62}{55}\Omega$

Answer: B

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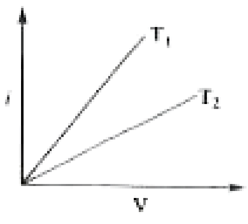
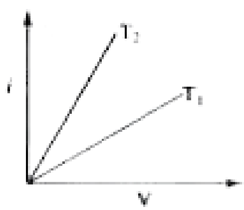
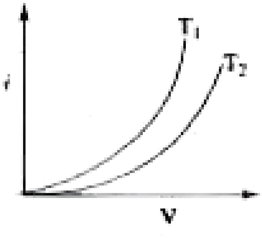
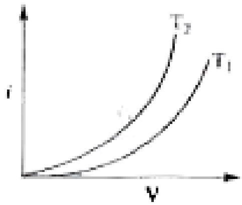
11. If k_1 rate constant at temperature T_1 and k_2 = rate constant at temperature T_2 for a first order reaction, then which of the following relations is correct? (E_a : activation energy)

A. 

B. 

C. 

D. 

Answer: A

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LECTURE SHEET (EXERCISE- II LEVEL- II (ADVANCED) (Linked Comprehension Type Questions))

1. Passage :

The thermal coefficient of resistivity is given by $\alpha = \frac{1}{\rho}\frac{d\rho}{dT}$ where ρ is resistivity at a temperature T. α is not constant, rather varies as $\alpha = \frac{-n}{T}$, where T is temperature in Kelvin and n is a constant. For carbon

$\alpha = -0.0005K^{-1}$ and $\rho = 3.5 \times 10^{-5}(\Omega - m)\text{at}27^{\circ}C$

Find the value of .n. for carbon

A. $\rho \propto T^{n}$

B. $\rho \propto T^{n-1}$

C. $\rho \propto T^{-n}$

D. $\rho \propto \frac{n}{T}$

Answer: C

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2. Passage :

The thermal coefficient of resistivity is given by $\alpha = \frac{1}{\rho}\frac{d\rho}{dT}$ where ρ is resistivity at a temperature T. α is not constant, rather varies as $\alpha = \frac{-n}{T}$, where T is temperature in Kelvin and n is a constant. For carbon $\alpha = -0.0005K^{-1}$ and $\rho = 3.5 \times 10^{-5}(\Omega - m)\text{at}27^{\circ}C$

Find the value of .n. for carbon

A. 0.15

B. 0.3

C. 0.9

D. 0.6

Answer: A

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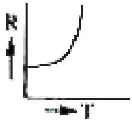
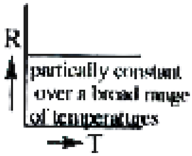
LECTURE SHEET (EXERCISE- II LEVEL- II (ADVANCED) (Matrix Matching Type Questions))

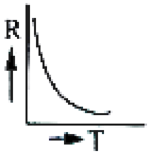
1. Each figure in Column - I shows the variation of resistance with temperature. Some materials are mentioned in Column - II. Match Column - I with

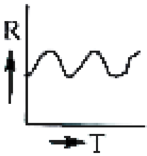
Column - II.

COLUMN - I

A) 

B) 

C) 

D) 

COLUMN - II

p) Manganin

q) Graphite

r) Copper

s) Silicon

t) none.

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LECTURE SHEET (EXERCISE-III LEVEL- I (MAIN) (Straight Objective Type Questions))

1. The emf of a storage battery is $90V$ before charging and $100V$ after charging. When charging began the current was $10A$. What is the current at the end of charging if the internal resistance of the storge battery during the whole process of charging may be taken as constant and equal to 2Ω?

A. 5A

B. 10A

C. 15 A

D. 20 A

Answer: A

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2. How will you connect (series and parallel) 24cells each of internal resistance 1Ω to get maximum power output across a load of 10Ω?

A. a = 6, b = 4

B. a = 8, b = 3

C. a = 2, b = 12

D. a = 1, b = 24

Answer: C

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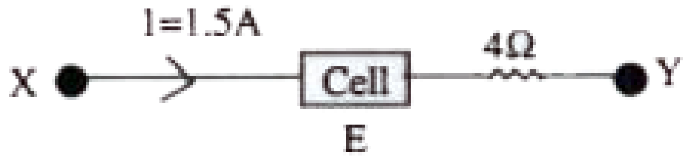
3. Fig. shows a part of circuit. When a current I = 1.5 A passes through it in the direction shown, power delivered to it (section XY) is 75W. Potential difference between X and Y and also the emf E of the cell are respectively (assume that the cell has a negligible internal resistance)



A. 50 V, 44 V

B. 50 V, 48 V

C. 36 V, 50 V

D. 48 V, 50 V

Answer: A

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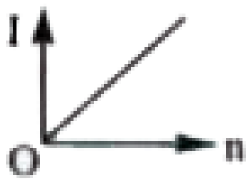
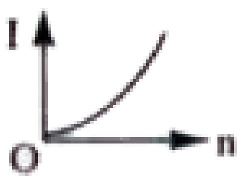
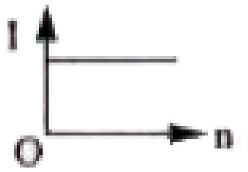
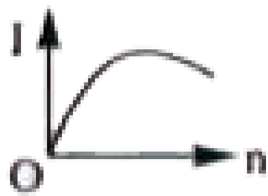
4. A battery consists of a variable number (n) of identical cells, each having an internal resistance r connected in series. The terminals of the battery are short - circuited. A graph of current versus the number of cell will be:

A. 

B. 

C. 

D. 

Answer: D

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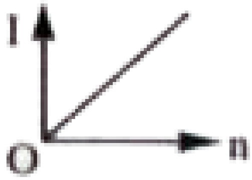
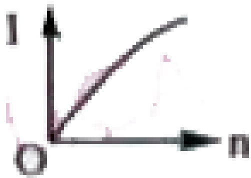
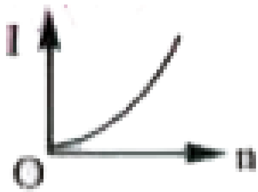
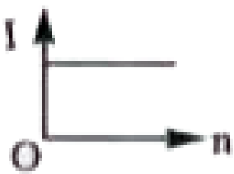
5. if the cell had been connected in parallel (instead of in series) which of the graphs would have shown the relationship between total current I and n?

A. 

B. 

C. 

D. 

Answer: A

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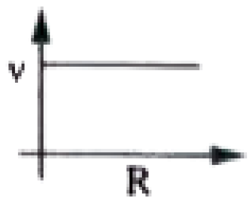
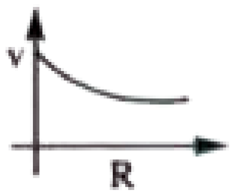
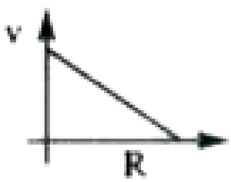
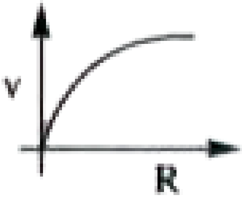
6. A cell having an emf E and internal resistance r is connected across a variable external resistance R. As the resistance R is increased, the plot of potential difference V across R is given by

A. 

B. 

C. 



D.

Answer: D

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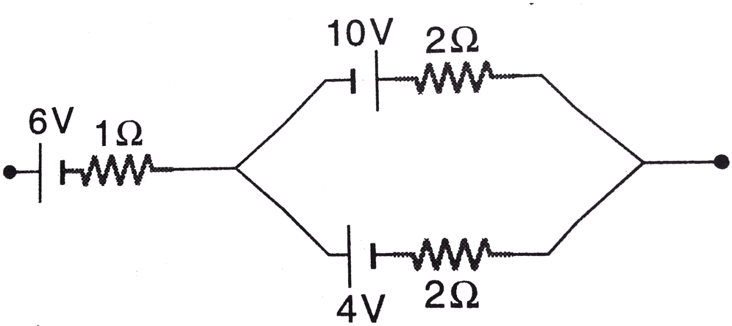
7. Find the emf and internal resistance of a single battery which is equivalent to a combination of three batteries as show in figure.



A. 3V, 5Ω

B. 3V, 2Ω

C. 7V, 2Ω

D. 20V, 5Ω

Answer: B

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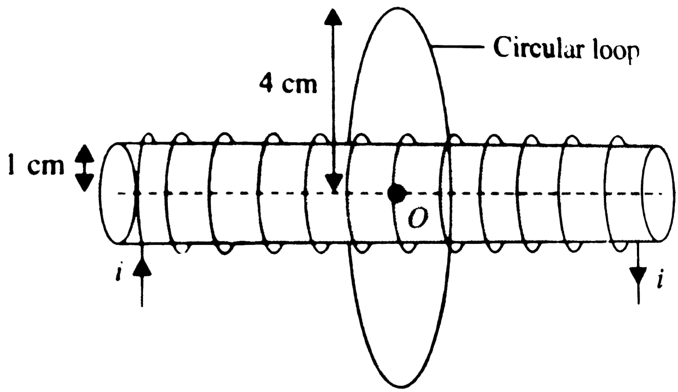
LECTURE SHEET (EXERCISE-III LEVEL- II (ADVANCED) (Straight Objective Type Questions))

1. A long solenoid having n = 200 turns per metre has a circular cross-section of radius $a_1 = 1cm$. A circular conducting loop of radius $a_2 = 4cm$ and resistance $R = 5(\Omega)$ encircles the solenoid such that the centre of circular loop coincides with the midpoint of the axial line of the solenoid and they have the same axis as shown in Fig.



A current 't' in the solenoid results in magnetic field along its axis with magnitude $B = (\mu)ni$ at points well inside the solenoid on its axis. We can neglect the insignificant field outside the solenoid. This results in a magnetic flux $(\phi)_B$ through the circular loop. If the current in the winding of solenoid is changed, it will also change the magnetic field $B = (\mu)_0 ni$ and hence also the magnetic flux through the circular loop. Obvisouly, it will result in an induced emf or induced electric field in the circular loop and an induced current will appear in the loop. Let current in the winding of solenoid be reduced at a rate of $75A / \sec$.

When the current in the solenoid becomes zero so that external magnetic field for the loop stops changing, current in the loop will follow a differenctial equation given by [You may use an approximation that field at all points in the area of loop is the same as at the centre

A. Only one value of R exist for which potential difference across battery having internal resistance r_1 is zero

B. Only one value of R exist for which potential difference across battery having internal resistance r_2 is zero

C. No value of R exist for which potential difference across any of the battery is zero

D. For all values of R potential difference across both the batteries would be zero

Answer: A

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2. The two batteries of emf E_1 and E_2 having internal resistances r_1 and r_2 respectively are connected in series to an external resistor R. Both the batteries are gatting discharged. The above described combination of these two batteries has to produce a weaker current then when any one of the battery is connected to same resistor. For this requirement to be fulfilled.

A. $\frac{E_2}{E_1}$ must not lie between $\frac{r_2}{r_1+R}$ and $\frac{r_2+R}{r_1}$

B. $\frac{E_2}{E_1}$ must lie between $\frac{r_2}{r_1+R}$ and $\frac{r_2+R}{r_1}$

C. $\frac{E_2}{E_1}$ must lie between $\frac{r_2}{r_1+R}$ and $\frac{r_1}{r_2+R}$

D. $\frac{E_2}{E_1}$ must not lie between $\frac{r_2}{r_1+R}$ and $\frac{r_1}{r_2+R}$

Answer: A

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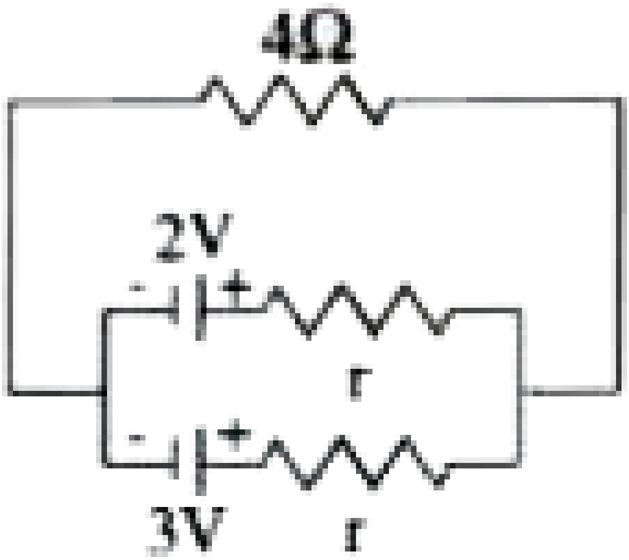
3. Two cell with unequal emfs of 2V and 3V are connected as shown in the figure. If each cell has an internal resistance r = 0.45Ω and external resistance is of 4Ω. Then, Potential drop across resistor 4Ω is



A. 5.32V

B. 2.37V

C. 3.28V

D. 1.5V

Answer: B

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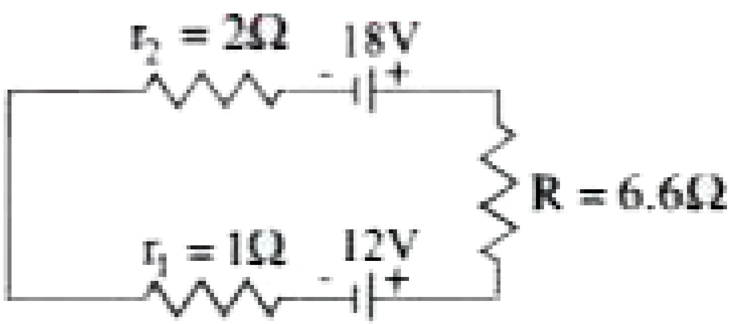
4. For the given circuit, terminal potential differences of cells are around



A. 15V,10V

B. 12V, 15V

C. 6V, 12V

D. 17V, 13V

Answer: D

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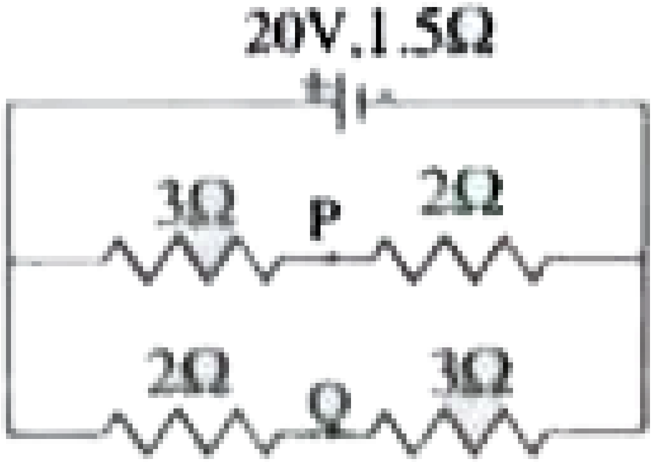
5. For the given circuit,



If internal resistance of cell is 1.5Ω, then

A. $V_P - V_Q = 0$

B. $V_P - V_Q = 4V$

C. $V_P - V_Q = -4V$

D. $V_P - V_Q = -2.5V$

Answer: D

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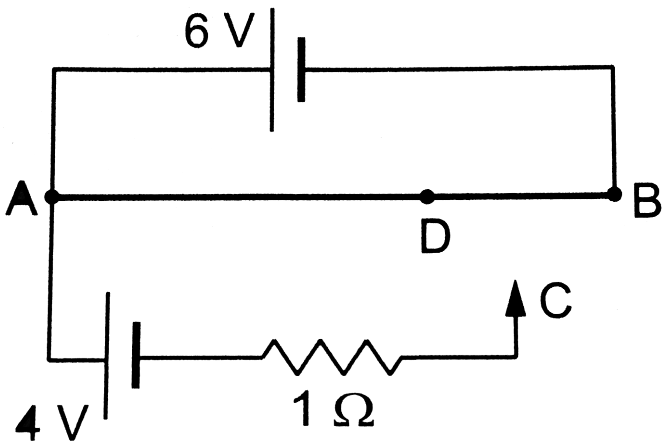
LECTURE SHEET (EXERCISE-III LEVEL- II (ADVANCED) (Linked Comprehension Type Questions)

1. A 6-volt battery of negligible internal resistance is connected across a uniform wire AB of length 100cm. The positive terminal of another battery of emf 4V and internal resistance $1(\Omega)$is joined to the point A as shown in figure.Take the potential at B to be zero. (a) What are the potentials at the poits A and C ? (b) At which point D of the wire AB, the potential is equal to the potential at C?(c) If the point C and D are connected by a wire, what will be the current through it ? (d) If the 4V battery is replaced by 7.5V battery,wht would be the answer of parts (a) and (b) ?



A. 6V, 2V

B. 8V, 4V

C. 6V, 4V

D. 8V, 3V

Answer: A

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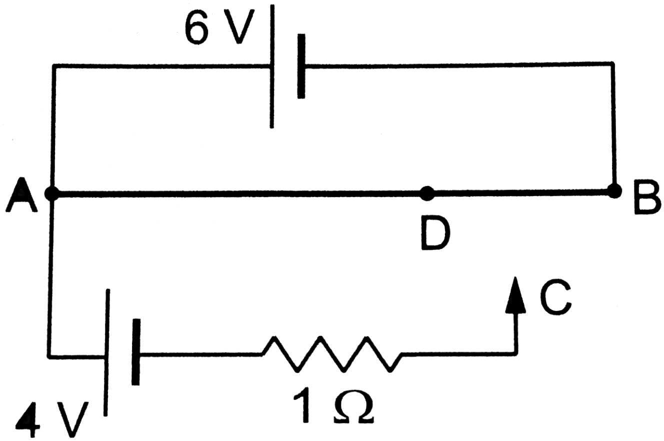
2. A 6-volt battery of negligible internal resistance is connected across a uniform wire AB of length 100cm. The positive terminal of another battery of emf 4V and internal resistance $1(\Omega)$is joined to the point A as shown in figure.Take the potential at B to be zero. (a) What are the potentials at the poits A and C ? (b) At which point D of the wire AB, the potential is equal to the potential at C?(c) If the point C and D are connected by a wire, what will be the current through it ? (d) If the 4V battery is replaced by 7.5V battery,wht would be the answer of parts (a) and (b) ?



A. AD = 60 cm

B. AD = 50 cm

C. AD = 40 cm

D. AD = $\frac{200}{3}$ cm

Answer: D

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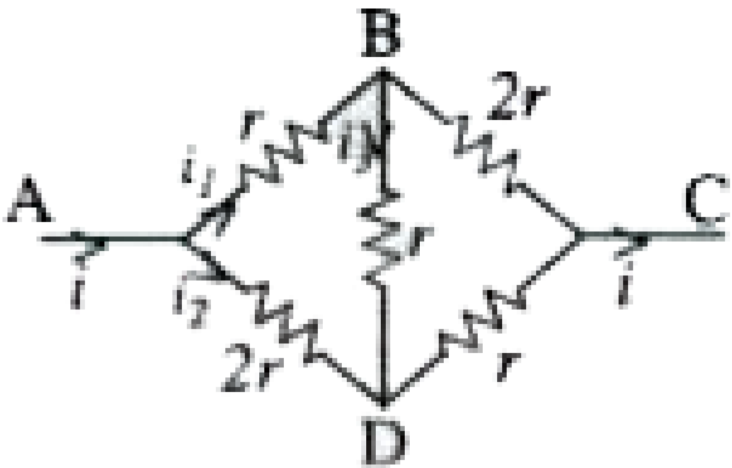
LECTURE SHEET (EXERCISE-IV LEVEL - I (MAIN) (Straight Objective Type Questions))

1. The value of current i_1 in the given circuit is



A. $\frac{i}{5}$

B. $\frac{2i}{5}$

C. $\frac{3i}{5}$

D. $\frac{4i}{5}$

Answer: C

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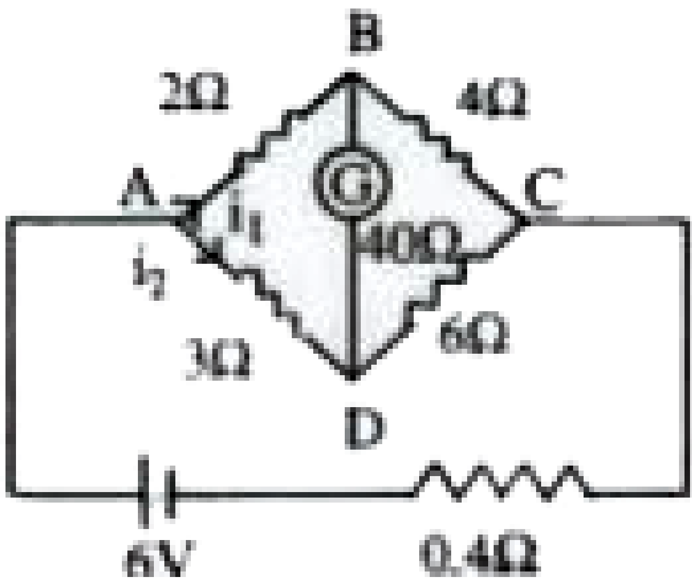
2. A balanced wheatstone bridge is shown the values of currents i_1 and i_2 are



A. 0.9A, 0.6A

B. 0.3A, 0.2A

C. 0.5A, 0.7A

D. 0.7A, 0.6A

Answer: A

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3. A metallic conductor at $10^{\circ} C$ connected in the left gap of Meter Bridge given balancing length 40cm. When the conductor is at $60^{\circ} C$, the balancing point shifts by__cm, (temperature coefficient of resistance of the material of the wire is $(1/220)/^{\circ} C$)

A. 4.8

B. 8.7

C. 15

D. 7

Answer: A

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4. Two unkonwn resistances X and Y are connected to left and right gaps of a meter bridge and the balancing point is obtained at 80cm from left. When a 10Ω resistance is connected parallel to X, the balancing point is 50cm from left. The values of X and Y respectively are

A. $40\Omega, 9\Omega$

B. $30\Omega, 7.5\Omega$

C. $20\Omega, 6\Omega$

D. $10\Omega, 3\Omega$

Answer: B

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5. In a metere bridge, the balance length from left end (standard resistance of 1Ω is in theright gap) is found to be 20cm the length of Resistance in left gap is $\frac{1}{2}m$ and radiusis 2mm its specific resistance is

A. $\pi \times 10^{-6} ohm - m$

B. $2\pi \times 10^{-6} ohm - m$

C. $\frac{\pi}{2} \times 10^{-6} ohm - m$

D. $3\pi \times 10^{-6} ohm - m$

Answer: B

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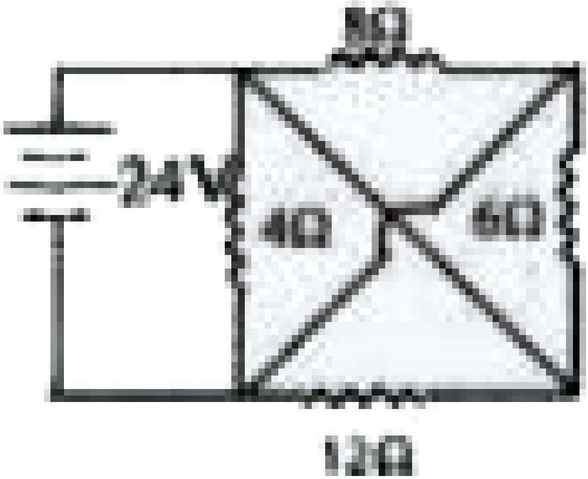
LECTURE SHEET (EXERCISE-IV LEVEL- II (ADVANCED) (Straight Objective Type Questions))

1. Calculate battery current and equivalent resistance of the network shown in figure.



A. 20V, 5Ω

B. $5A, \frac{8}{5}\Omega$

C. $15A, \frac{8}{5}\Omega$

D. $9A, \frac{8}{3}\Omega$

Answer: C

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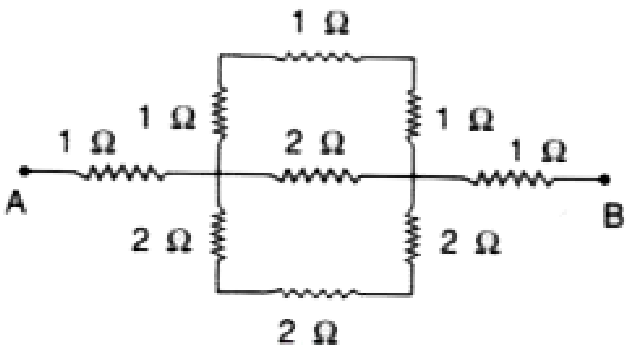
2. Calculate the effective resistance between the points A and B in the circuit shown in Fig.



A. `2V, i = I_(1)+I_(2)+I_(3)=2amp

B. $5V, I_1 = I_2 = I_3 = 0$

C. $2V, I_1 = I_3 = 1A, I_2 = 0$

D. $2V, I_1 = 1A, I_2 = 2A, I_3 = 3A$

Answer: C

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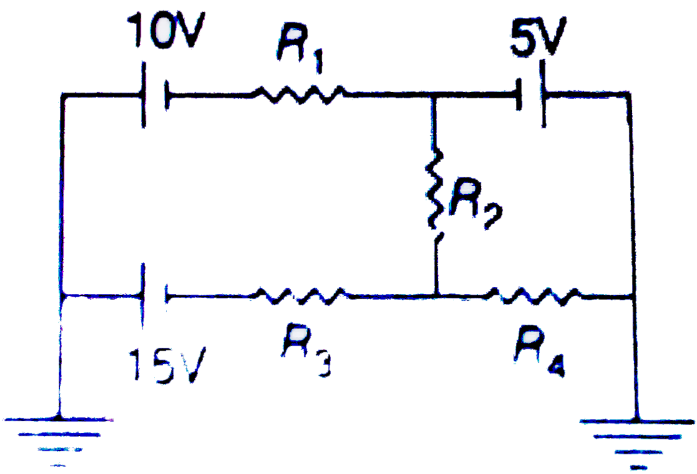
LECTURE SHEET (EXERCISE-IV LEVEL- II (ADVANCED) (Linked Comprehension Type Questions))

1. In the circuit shown in figure



Current through R_2 is zero if $R_4 = 2\Omega$ and $R_3 = 4\Omega$

In this case

A. current through R_3 is 2A

B. current through R_4 is 3A

C. both (a) and (b) are correct

D. both (a) and (b) wrong

Answer: D

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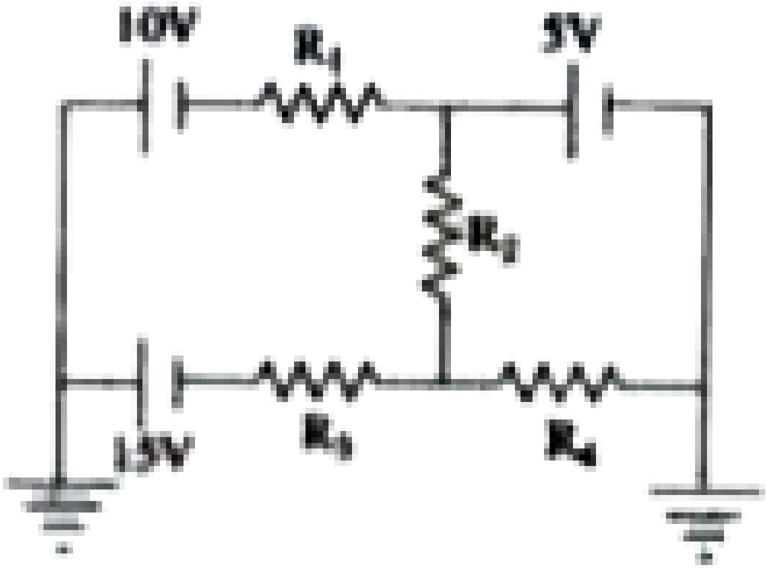
2. Passage :

In the circuit shown in figure :



Current through R_1 is independent of :

A. R_2

B. R_3

C. R_4

D. all of these

Answer: D

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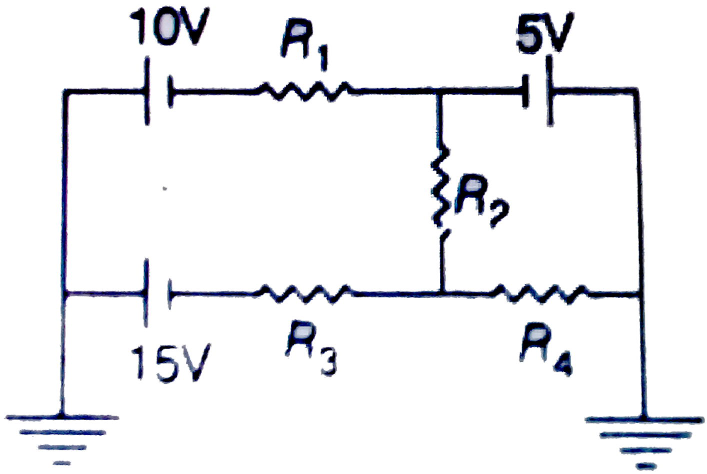
3. In the circuit shown in figure



For what ratio $\frac{R_2}{R_4}$, current through R_3 will be zero

A. $1:1$

B. $1:2$

C. $1:3$

D. Not possible

Answer: D

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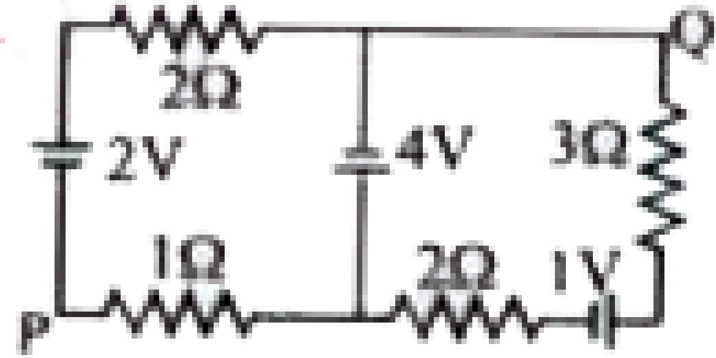
LECTURE SHEET (EXERCISE-IV LEVEL- II (ADVANCED) (Integer Type Questions))

1. In the circuit shown, what is the potential difference V_{PQ} in volts ?



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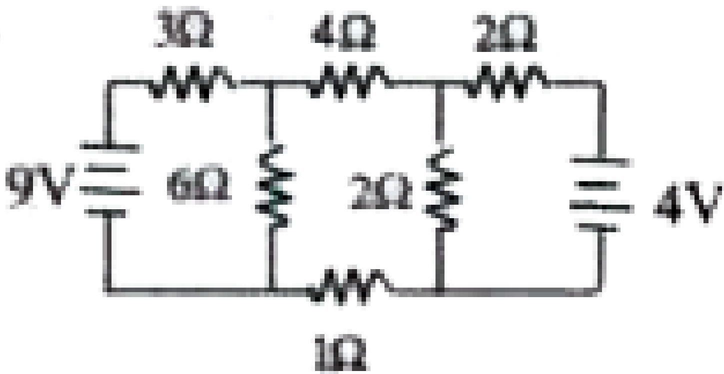
2. For the circuit shown in figure, determine the voltage across 4Ω resistors in volt ?



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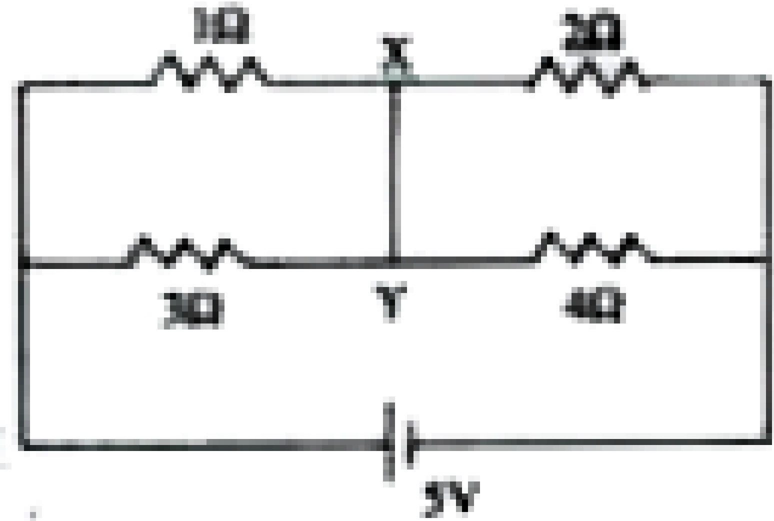
3. The circuit shown in figure, find the current through wire XY in ampere



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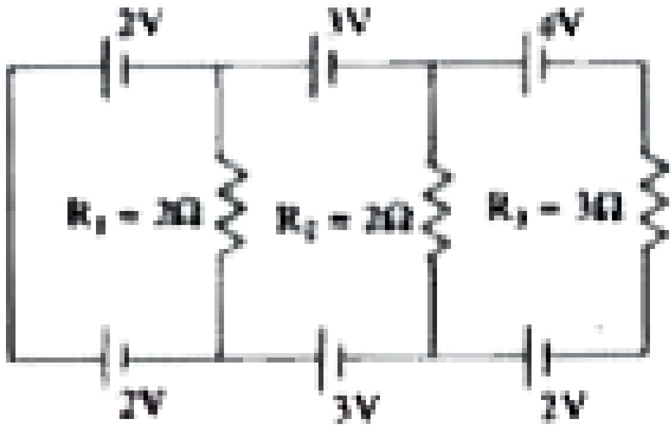
4. The current in resistance R_3 in the given circuit is $\frac{2}{x}$ A Find the value of x.



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LECTURE SHEET (EXERCISE-V LEVEL - I (MAIN) (Straight Objective Type Questions))

1. Tha scale of a galvanometer is divided into 150 equal divisions.The galvanometer has a current sensitivity of 10 divisions per mA and a voltage sensitivity of 2 divisions per mV . The galvanometer be designed to read (i) 6 A per division and (ii) $1V$ per division?

A. $40\mu\Omega$ is connected in parallel, 1000Ω is connected in series

B. $20\mu\Omega$ is connected in parallel, 9995Ω is connected in series

C. $8.3\mu\Omega$ is connected in parallel, 9995Ω is connected in series

D. $8.3 \times 10^{-5}\Omega$ is connected in parallel, 9995Ω is connected in series

Answer: D

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2. A moving coil galvanometer of resistance 20Ω gives a full scale deflection when a current of $1mA$ is passed through it. It is to be converted into an ammeter reading $20A$ on full scale. But the shunt of 0.005Ω only is available. What resistance should be connected in series with the galvanometer coil?

A. 59.995 Ω

B. 79.995 Ω

C. 69.995Ω

D. 89.995 Ω

Answer: B

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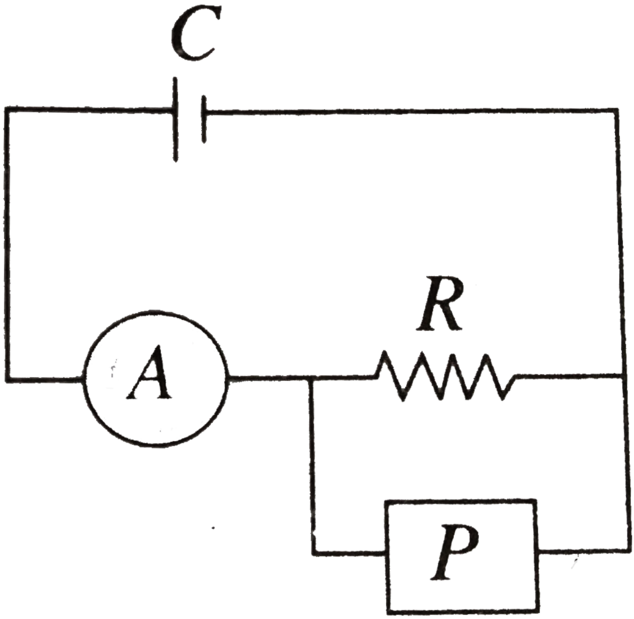
3. An ammeter A of finite resistance and a resistor R are joined in series to and ideal cell C. A potentiometer P is joined in parallel to R. The ammeter reading is I_0 and the potentiometer reading is V_0. P is now replaced by a voltmeter of finite resistance. The ammeter reading now is I and the voltmeter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



A. $I > I_0, V < V_0$

B. $I > I_0, V = V_0$

C. $I = I_0, V < V_0$

D. $I < I_0, V = V_0$

Answer: A

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4. An ammeter is connected to measure the current intensity in a circuit with a resistance R. What relative error will be made if connection of the ammeter does not change the current intensity in the circuit? The voltage across the ends of the circuit is kept constant.

A. $\dfrac{R}{R_0}$

B. $\dfrac{R_0}{R}$

C. $\dfrac{1}{1+\frac{R}{R_0}}$

D. $\dfrac{1}{1+\frac{R_0}{R}}$

Answer: C

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5. The voltage across a resistance R is determined using a voltmeter connected to its ends. What relative error will be made if the readings of the voltmeter are taken as the voltage applied before it was switched on ? The current intensity in the circuit is constant.

A. $\frac{R}{R_0}$

B. $\frac{R_0}{R}$

C. $\frac{1}{1+\frac{R}{R_0}}$

D. $\dfrac{1}{1+\frac{R_0}{R}}$

Answer: D

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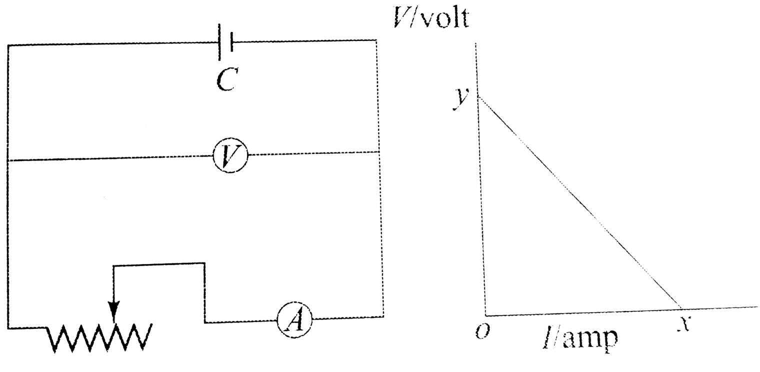
6. shows a circuit used in an experiment to detrmine the emf and interanl resistance of the battery C. A graph was plotted of the potential difference V between the terminals of the battery against the current I, which was varied by adjusting the rheostat. The graph is shown in x and y are the intercepts of the graph with the axes as shown. What is the internal resistance of the battery?



(a) (b)

A. x

B. y

C. x/y

D. y/x

Answer: D

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LECTURE SHEET (EXERCISE-V LEVEL-II (ADVANCED) (Straight Objective Type Questions))

1. A galvanometer has a current sensitivity of 1 mA per division. A variable shunt is connected across the galvanometer and the combination is put in series with a resistance of 500Ω and cell of internal resistance 1Ω. It gives a deflection of 5 division for shunt of 5 ohm and 20 division for shunt of 25 ohm. The emf of cell is

A. 50V, 100Ω

B. 47.1V, 882Ω

C. 68.4V, 23.4Ω

D. 23.5V, $90.3\ \Omega$

Answer: B

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2. The weight of an object on the surface of the Earth is 40 N. Its weight at a height equal to the radius of the Earth is

A. $\dfrac{V_0}{R+r}$

B. $\dfrac{V_0(R+r)}{Rr}$

C. $\dfrac{V_0 R}{r(r+R/4)}$

D. $\dfrac{V_0 r}{R(r+R/4)}$

Answer: D

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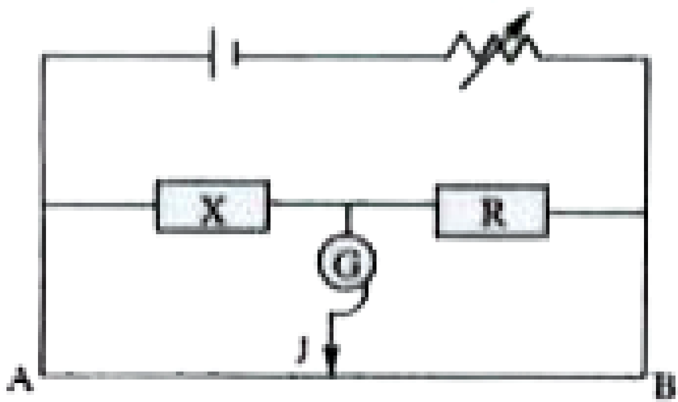
3. Figure shows a metre bridge in which a known resistance R and an unknown resistance X connected to it. The length of the total wire AB is 100cm. Then the balancing length for which the percentage error in measuring the value of x is minimum (neglect end corrections)



A. 0 cm

B. 33.3 cm

C. 50 cm

D. 100 cm

Answer: C

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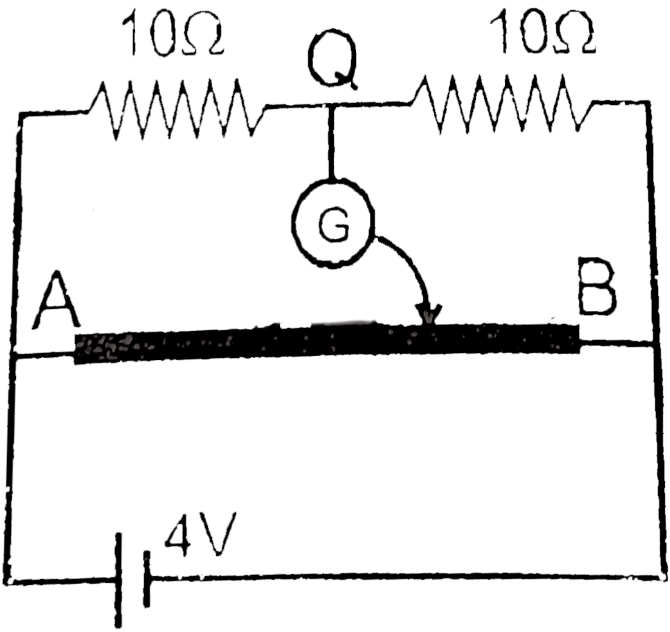

4.

A potentiometer wire AB as shown in 40 cm long of resistance $50\Omega/m$ free end of an ideal galvanometer is touching the potentiometer wire with the help of a jockey. What should be the velocity of the jockey as a function of time so that potential difference across the galvanometer is varying with time as $(2\sin \pi t)V$

A. $10\pi \sin \pi t cm / s$

B. $10\pi \cos \pi t cm / s$

C. $20\pi \sin \pi t cm / s$

D. $20\pi \cos \pi t cm / s$

Answer: D

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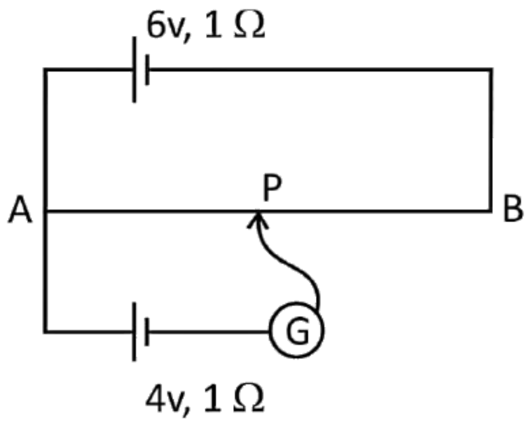
5. A 6V battery of internal resistance 1Ω is connected across a uniform wire AB of length 100 cm. The positive terminal of another battery of E.M.F 4V and internal resistance 1Ω is joined to the point A as shown. The distance of point P from A is $\alpha \times 10 cm$. Find the value of α, for which there is no current through the galvanometer. (resistance of AB wire is 5Ω)



A. 80 cm

B. 60 cm

C. 75 cm

D. 40 cm

Answer: A

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LECTURE SHEET (EXERCISE-VI LEVEL - I (MAIN) (Straight Objective Type Questions))

1. A 100 watt immersion heater is placed in a pot containing 1 litre of waterr at 20° C. How long will it take to heat water to boiling temperature if 20% of the available energy is lost to surroundings?

A. 60 minutes

B. 70 minutes

C. 44 minutes

D. 32 minutes

Answer: A

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2. The same mass of aluminium is draw into two wires 1mm and 2mm thick . Two wires are connected in series and current is passed through them. Heat produced in the wires is in the ratio.

A. $16:1$

B. $1:1$

C. $4:1$

D. $9:1$

Answer: A

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3. A long wire is divided into 2n parts . Then n parts are connected in series and the other n parts are connected in parallel . Both the combinations are given the same voltage. Supply. The ratio of heat produced in series to the parallel combination will be

A. $1:1$

B. $1:n^2$

C. $1:n^4$

D. $n^2:1$

Answer: B

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4. A resistance coil of 60 ohm is immersed in 42000 gm of water. A current of 7A is passed through it. Calculate the rise in temperature per minute. The sp. Heat of water = $4200 \frac{J}{kg - {}^{\circ}K}$

A. $5^{\circ} C$

B. $3^{\circ} C$

C. $2^{\circ} C$

D. $1^{\circ} C$

Answer: D

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5. The maximum voltage that can be applied to $5K\Omega$ and 8W resistor without exceeding its heat dissipating capacity is

A. 100 V

B. 400 V

C. 160 V

D. 200 V

Answer: D

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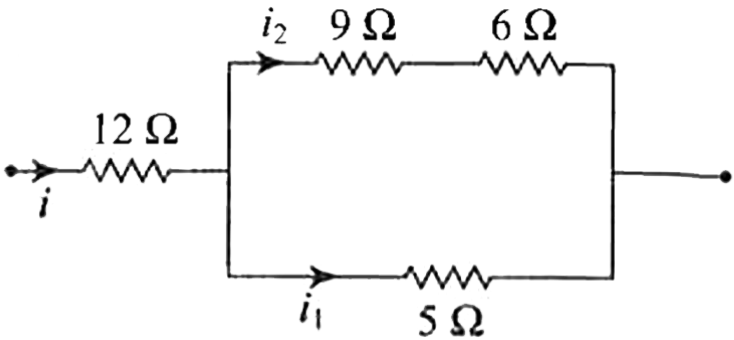
6. In the following circuit, 5Ω resistor develops $45\frac{J}{s}$ due to current flowing through it. The power developed per second across 12Ω resistor is



A. 16 W

B. 192 W

C. 36 W

D. 64 W

Answer: B

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7. Two wires A and B of the same material and mass have their length in the ratio $1:2$. On connecting them to the same source, the ratio of heat dissipation in B is found to be 5W. The rate of heat dissipation in A is

A. 10W

B. 5W

C. 20W

D. None of these

Answer: C

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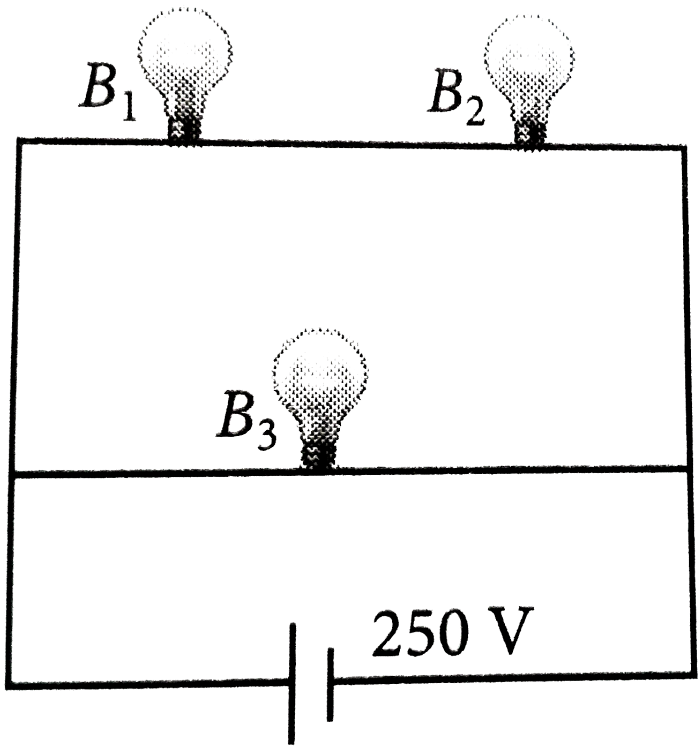
8. A 100 W bulb B_1 and two 60W bulbs B_2 and B_3, are connected to a 250 V source, as shown in figure. Now W_1, W_2 and W_3 are the output powers of the bulbs

B_1, B_2 and B_3, respectively. Then



A. $W_1 > W_2 = W_3$

B. $W_1 > W_2 > W_3$

C. $W_1 < W_2 = W_3$

D. $W_1 < W_2 < W_3$

Answer: D

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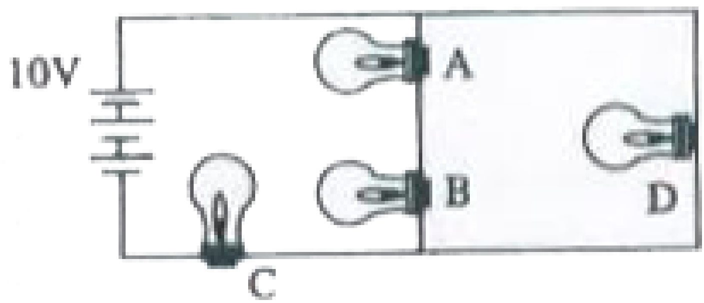
9. In the circuit diagram, all the bulbs are identical. Which bulb will be the brightest?



A. A

B. B

C. C

D. D

Answer: C

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LECTURE SHEET (EXERCISE-VI LEVEL- II (ADVANCED) (Straight Objective Type Questions))

1. A total charge Q flows across a resistor R during a time interval T in such a way that the current versus time graph for 0 to T is like the loop of a sine curve in the range $0 \text{ to } \pi$. The total heat generated in the resistor is

A. $Q^2\pi^2 R/8T$

B. $2Q^2\pi^2 R/T$

C. $2Q^2\pi^2 R/4T$

D. $Q^2\pi^2 R/4T$

Answer: D

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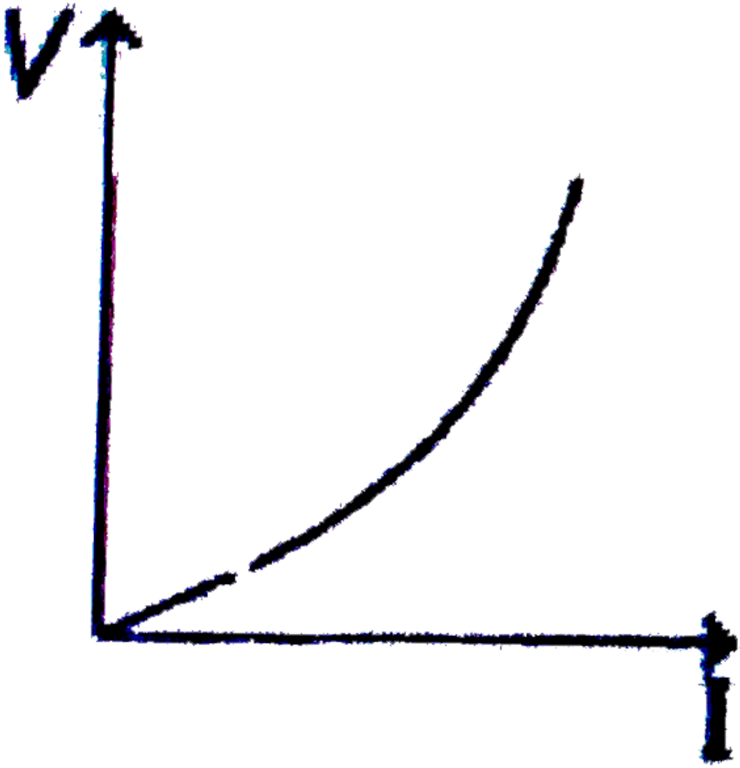
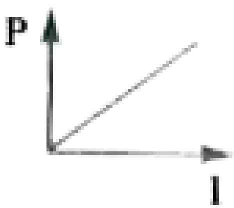
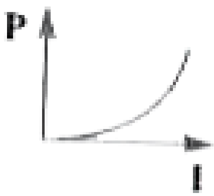
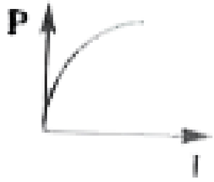
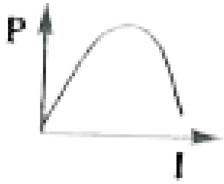
2. The variation of current (I) and voltage (V) across a resistance R is as shown in figure. The variation of power P with current I is best shown by which of the following graph



A. 

B. 

C. 

D. 

Answer: B

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3. The current I through a rod of a certain metallic oxide is given by $I = 0.2V^{1/2}$, where V is the potential difference cross it. The rod is connected in series with a resistance to a 6 volt battery of negligible internal resistance. What value should the series resistance have so that :

A) the current in the circuit is 0.4 A

B) the power dissipated in the rod is twice that dissipated in the resistance.

A. $10\Omega, 10\Omega$

B. $10\Omega, 5\Omega$

C. $5\Omega, 10\Omega$

D. $5\Omega, 5\Omega$

Answer: D

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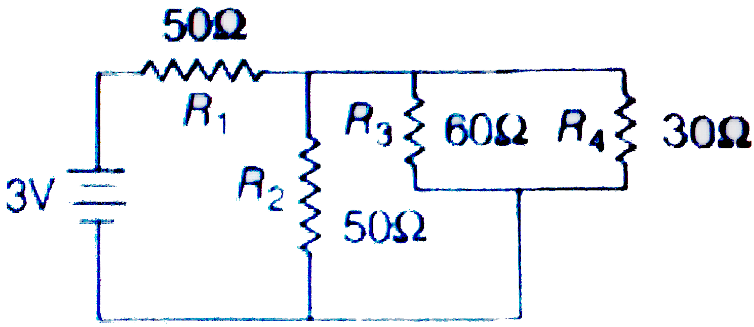
4. In the circuit shown, the resistance are given ohms and the battery is assumed ideal with end equal to 3.0 volts. The resistance that dissipates the maximum power is



A. R_1

B. R_2

C. R_3

D. R_4

Answer: A

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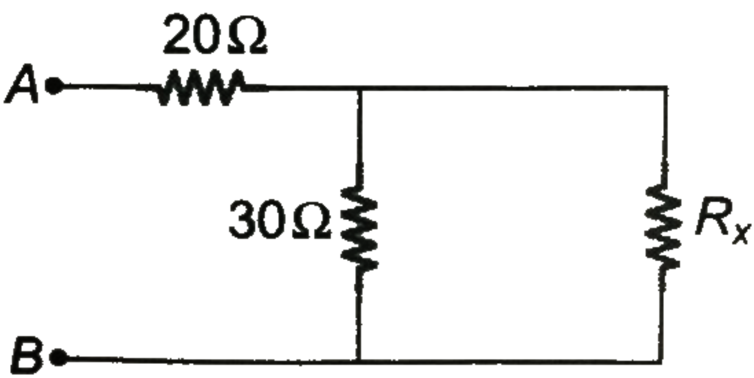
5. A circuit shown in the figure has resistances 20Ω and 30Ω. At what value of resistance R_x will the thermal power generated in it be practically independent of small variations of that resistance? The voltage between points A and B is supposed to be constant in this case.



A. 3Ω

B. 7Ω

C. 12Ω

D. 20Ω

Answer: C

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6. Two identical electric heaters each marked 1000 W 220 V are connected in series . This conbination is connected to an AC supply of 220 V . What will be their combined rate of heating? (Assume resistance of each heater remians contant

A. 1000 W

B. 2000 W

C. 500 W

D. 4000 W

Answer: C

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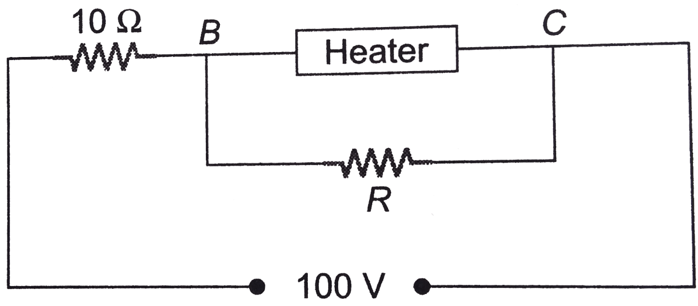
7. A heater is designed to operate with a power of $1000W$ in a $100V$ line. It is connected in combination with a resistance of 10Ω and a resistance R, to a $100V$ mains as shown in figure. What will be the value of R

so that the heater operates with a power of $62.5W$?



A. 10Ω

B. 62.5Ω

C. $\frac{1}{5}\Omega$

D. 5Ω

Answer: D

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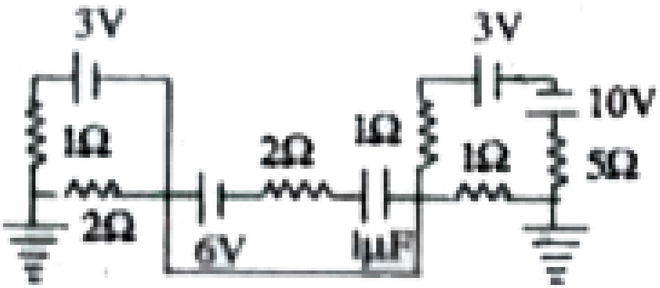
LECTURE SHEET (EXERCISE-VII LEVEL - I (MAIN) (Straight Objective Type Questions))

1. For the circuit shown in the figure, determine the charge of capacitor in steady state.



A. $4\mu C$

B. $6\mu C$

C. $1\mu C$

D. Zero

Answer: B

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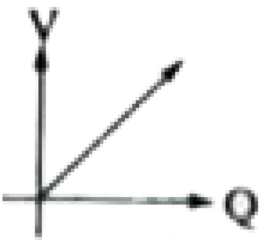
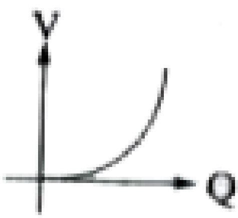
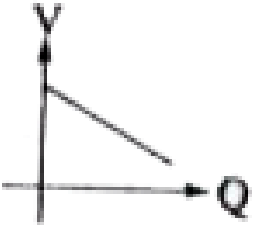
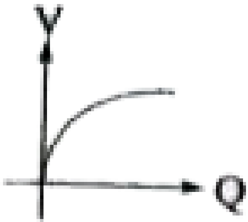
2. A capacitor is charged steadily from a DC source. Correct variation of potential difference across the plates of capacitor with charge on the plates of capacitor is

A. 

B. 

C. 

D. 

Answer: A

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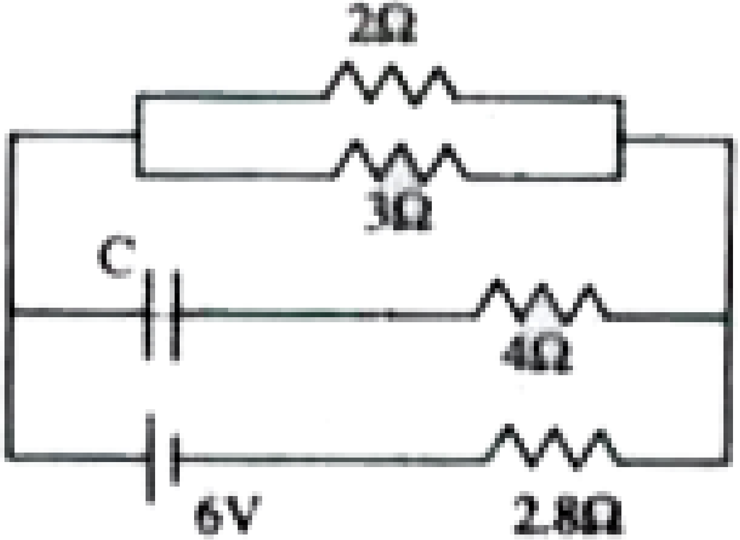
3. In the steady state, the charge on the capacitor capacity $0.2\mu F$ is



A. zero

B. $0.36\mu c$

C. $0.2\mu c$

D. $1.2\mu c$

Answer: B

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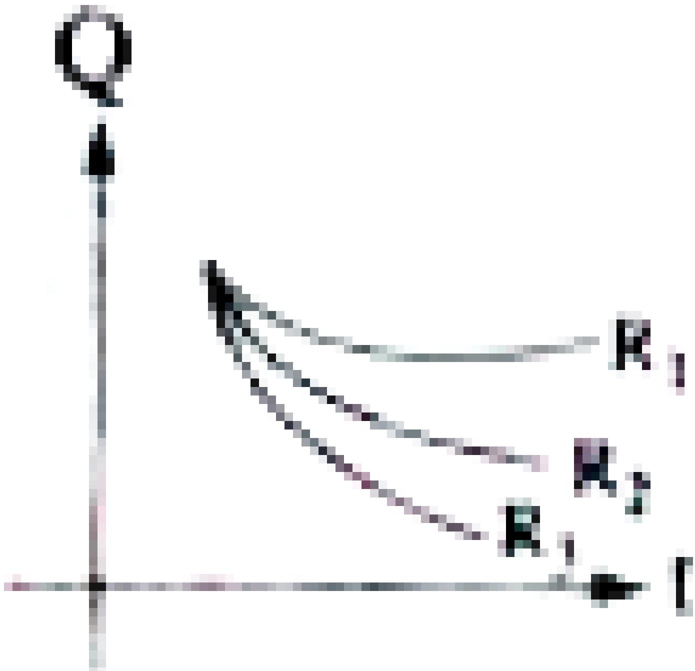
4. Three identical capacitors are charged by connecting them in parallel across a battery of V volt. They are then allowed to discharge via resistor R_1, R_2 and R_3. Here, Q charge versus t time graphs are shown. Then,



A. A) R_1 is smallest

B. B) R_2 is smallest

C. C) R_3 is smallest

D. D) $R_3 > R_2 > R_1$

Answer: A

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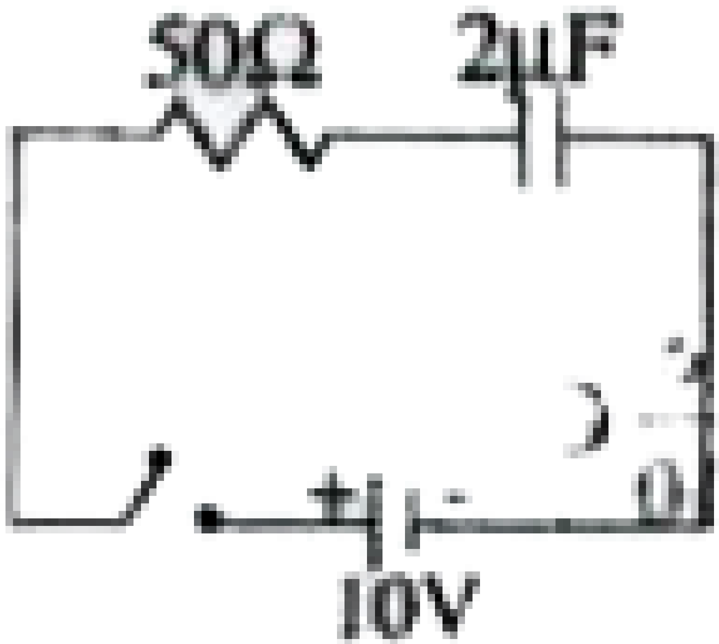
5. For the circuit shown in figure below, at t = 0, switch is closed, the initial current through resistor and final charge on capacitor are



A. $5A,\ 5\mu C$

B. $5A,\ 20\mu C$

C. $0.2A,\ 5\mu C$

D. $0.2A,\ 20\mu C$

Answer: D

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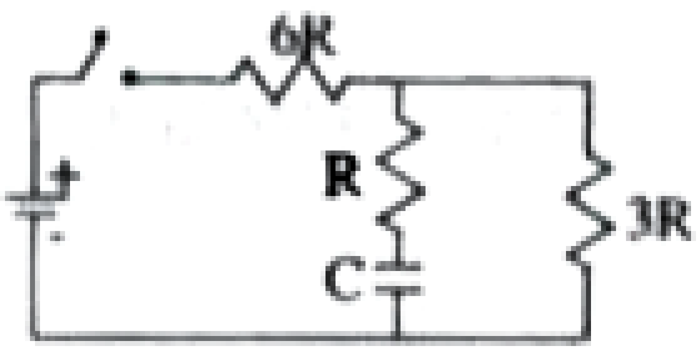
6. For the given circuit shown in figure below, time constant is



A. $\tau = RC$

B. $\tau = 2.1RC$

C. $\tau = 27/4RC$

D. $\tau = 3RC$

Answer: D

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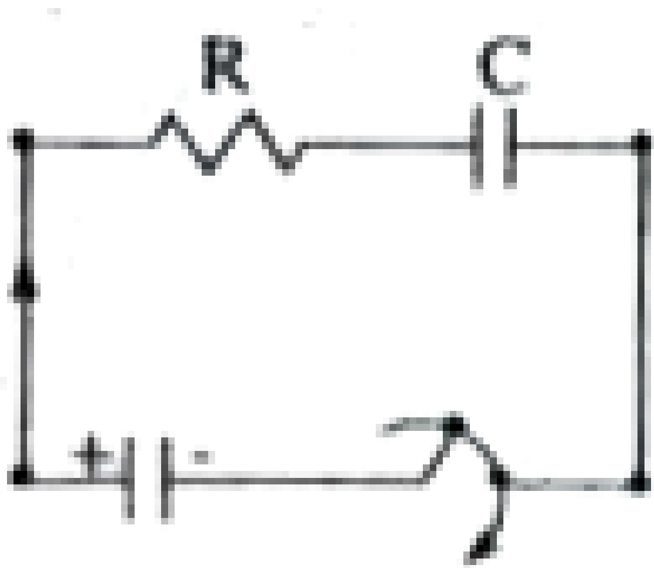
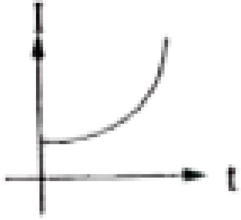
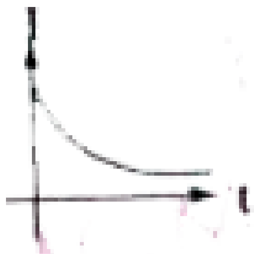
7. During charging of capacitor in the circuit shown,

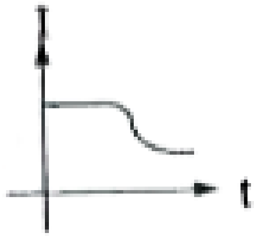


Circuit current versus time graph is

A. 

B. 

C. 

D. 

Answer: C

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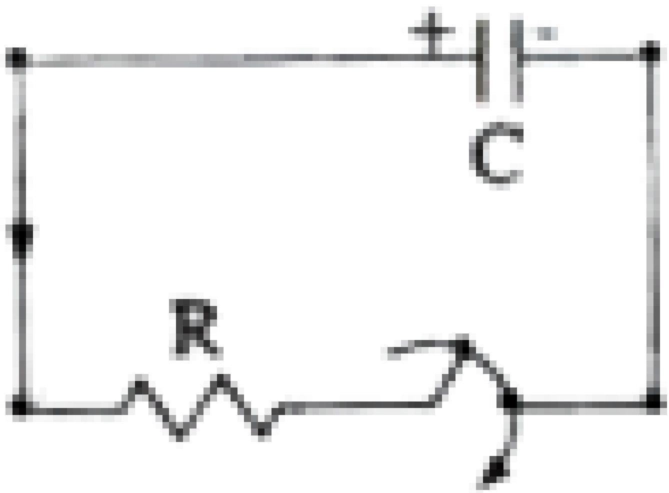
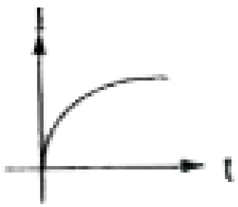
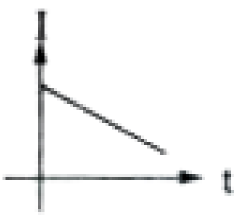
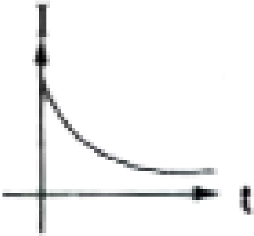
8. During discharging of a capacitor via a resistor

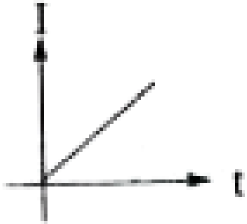


Circuit current varies with time as

A. 

B. 

C. 

D. 

Answer: C

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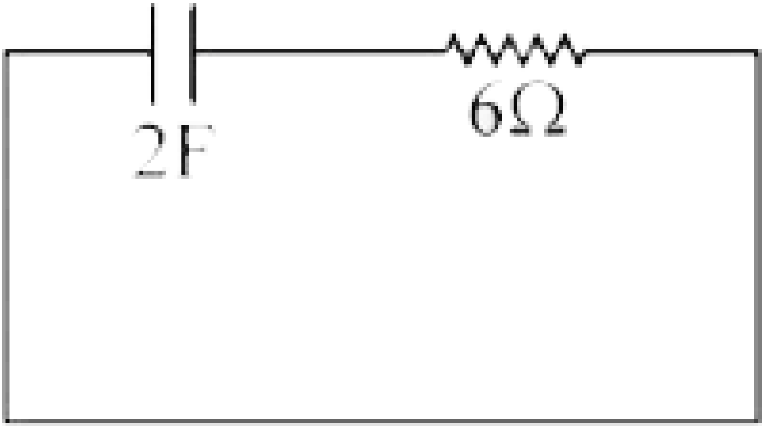
9. If the capacitor shown in the circuit is charged to 5V and left in the circuit, in 12s the charge on the capacitor will become:



A. $\frac{10}{e}C$

B. $\frac{e}{10}C$

C. $\frac{10}{e^2}$C

D. $\frac{e^2}{10}C(e = 2.718)$

Answer: A

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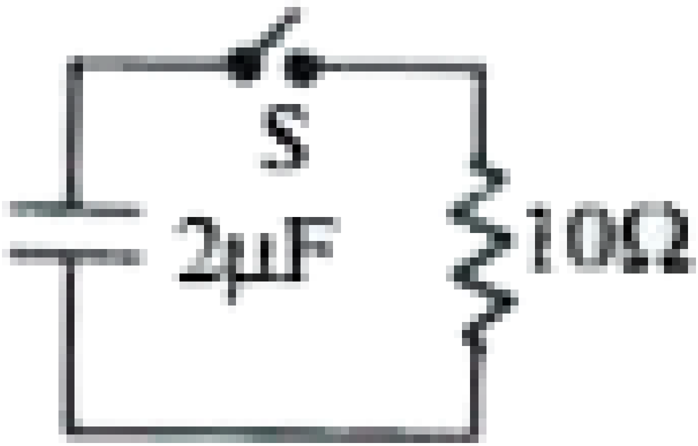
LECTURE SHEET (EXERCISE-VII LEVEL-II (ADVANCED) (Straight Objective Type Questions))

1. In the R-C circuit shown in the figure the total of $3.6 \times 10^{-3} J$ is dissipated in the 10 ohms resistor when the switch S is closed. The initial charge on the capacitor is



A. $60 \mu C$

B. $120 \mu C$

C. $60\sqrt{2}\mu C$

D. $\frac{60}{\sqrt{2}}\mu C$

Answer: B

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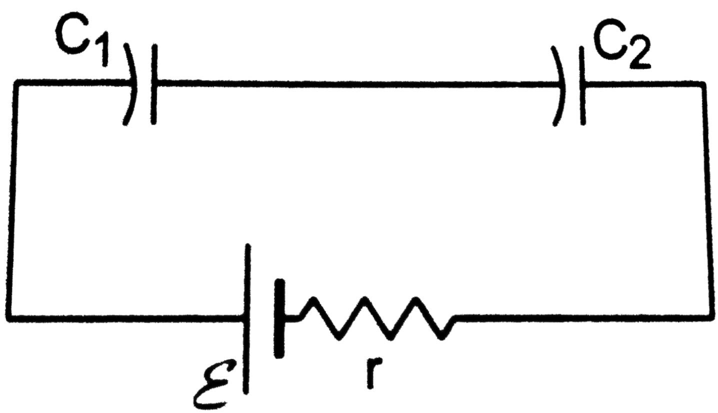
2. Consider the situation shown in figure.The switch is closed at $t = 0$when the capacitors are uncharged. find the charge on the capacitor C_1as a function of time t.



A. $q = \varepsilon C\left(1 - e^{-\frac{t}{rC}}\right)$ where $C = \dfrac{C_1 C_2}{C_1 + C_2}$

B. $q = \dfrac{\varepsilon C}{2}\left(1 - e^{-\frac{t}{rC}}\right)$ where $C = C_1 + C_2$

C. $q = \varepsilon C\left(1 - e^{-\frac{t}{rC}}\right)$ where $C = C_1 + C_2$

D. $q = \varepsilon C e^{-\frac{t}{nC}}$ where $C = \dfrac{C_1 C_2}{C_1 + C_2}$

Answer: A

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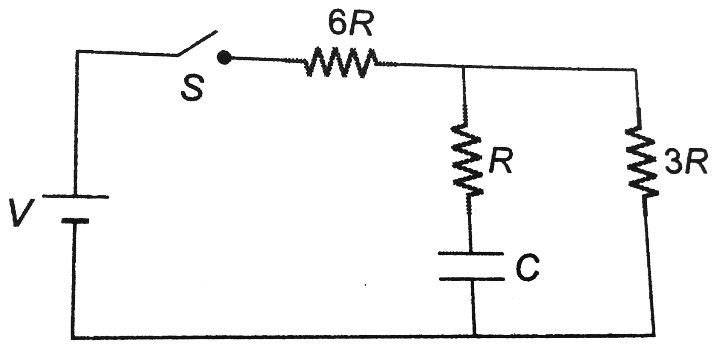
3. In the circuit shownin figure switch S is closed at time t=0. Find the current through different wire and charge stored on the capacitor at any time t.



A. $q = \frac{CV}{3}\left(1 - e^{\frac{-t}{3RC}}\right)$

B. $q = \frac{CV}{3}\left(1 - e^{\frac{-4t}{27RC}}\right)$

C. $q = CV\left(1 - e^{\frac{-t}{RC}}\right)$

D. $q = CV\left(1 - e^{\frac{-t}{7RC}}\right)$

Answer: A

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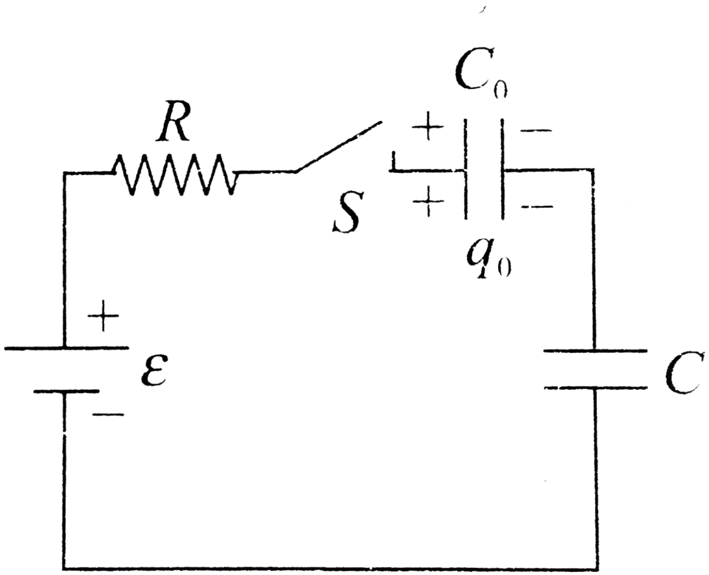
4. The switch S is closed at t = 0. the capacitor C is uncharged but C_0 has a charge q_0 at $t = 0$. Calculate the current $i(t)$ in the circuit



A. $\left[\dfrac{E - \dfrac{q_0}{C_0}}{R}\right] e^{-\frac{t}{RCeq}}$

B. $\dfrac{E}{R}\left(e^{-\frac{t}{RC_{eq}}}\right)$

C. $\dfrac{q_0}{C_0}\left[e^{-\frac{t}{RC_{eq}}}\right]$

D. $\left[\dfrac{E+\frac{q_0}{C_0}}{R}\right]e^{-\frac{t}{RC_{eq}}}$ where $C_{eq}=\dfrac{C_0C}{C_0+C}$

Answer: A

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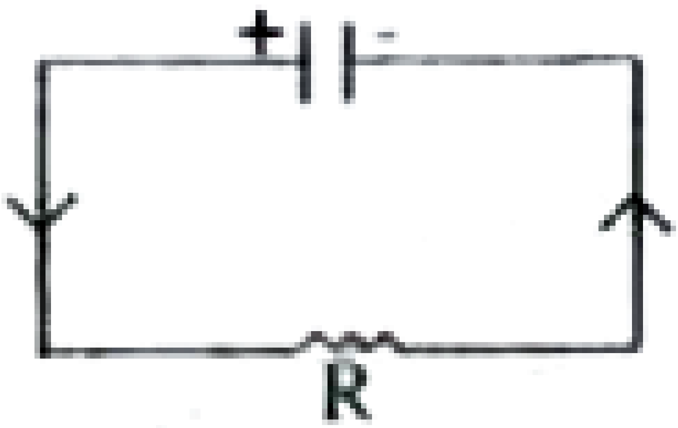
5. A capacitor given a charge Q_0 is conected across a resistor R at t = 0. The separation between the plates changes according to $d=\dfrac{d}{(1+t)}(0 \le t < 1)$ Find the variation of charge on capacitor with time.



A. $Q=Q_0(1+t)e^{\frac{-1}{RC_0}}$

B. $Q=Q_0(1+t)^{\frac{-1}{RC_0}}$

C. $Q=Q_0e^{\frac{-1}{RC_0}}$

D. $Q=Q_0e(1+t)^2e^{\frac{-1}{RC_0}}$

Answer: B

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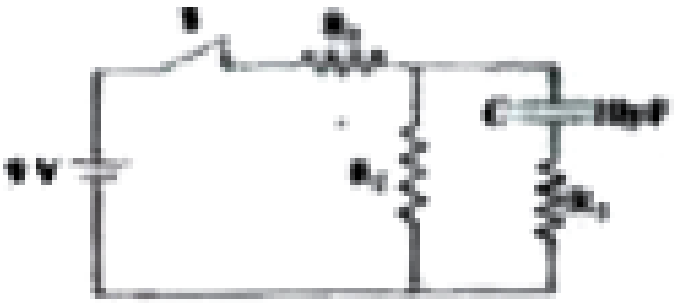
LECTURE SHEET (EXERCISE-VII LEVEL-II (ADVANCED) (Linked Comprehension Type Questions))

1. Passage :

Suppose the switch S has been sufficiently long time for the capacitor to become fully charged. Find (where

$R_1 = 12k\Omega,\ R_2 = 15k\Omega,\ R_3 = 5k\Omega$)



The steady-state current through each resistor

A. $I_1 = I_2 = 3mA,\ I_3 = 0$

B. $I_1 = 1A,\ I_2 = 2A,\ I_3 = 3A$

C. $I_1 = I_2 = I_3 = 1/3A$

D. $I_1 = I_2 = 1/3mA,\ I_3 = 0$

Answer: D

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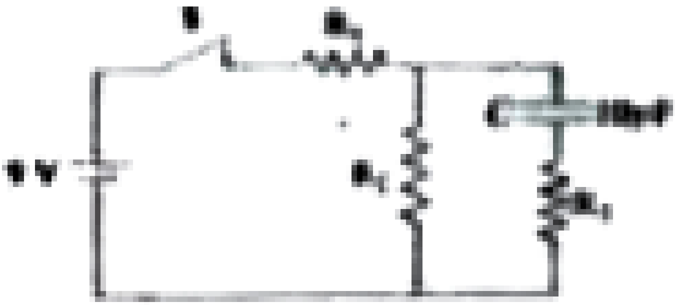
2. Passage :

Suppose the switch S has been sufficiently long time for the capacitor to become fully charged. Find (where $R_1 = 12k\Omega,\ R_2 = 15k\Omega,\ R_3 = 5k\Omega$)



In the above question the charge on the capacitor is

A. $50\mu C$

B. $100\mu C$

C. $90\mu C$

D. $40\mu C$

Answer: A

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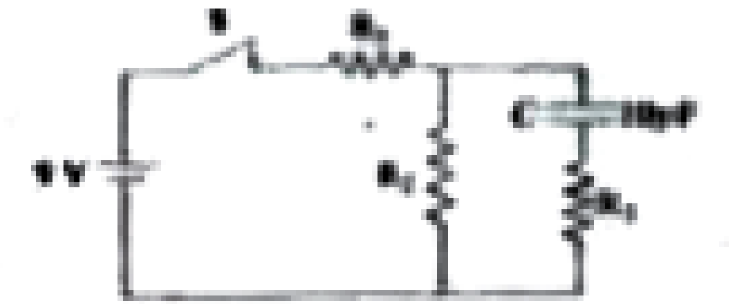
3. Passage :

Suppose the switch S has been sufficiently long time for the capacitor to become fully charged. Find (where $R_1 = 12k\Omega$, $R_2 = 15k\Omega$, $R_3 = 5k\Omega$)



The steady-state current through each resistor

A. 0.3s

B. 0.1386 s

C. 0.693 s

D. 0.367 s

Answer: B

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PRACTICE SHEET (EXERCISE - I LEVEL-I (MAIN) (Straight Objective Type Questions))

1. A current of 4.8 A is flowing in a conductor the number of electrons passing per sec through the conductor will be

A. 3×10^{19}

B. 7.68×10^{20}

C. 76.8×10^{19}

D. 3×10^{20}

Answer: A

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2. In a hydrogen atom, an electron is revolving with an angular frequency 6.28 rad/s around the nucleus. Then the equivalent electric current is ____ $10^{-19} A$

A. 0.16

B. 1.6

C. 0.016

D. 16

Answer: B

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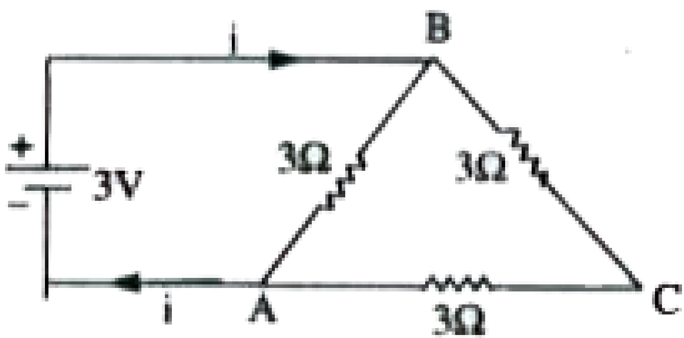
3. The current .i. in the circuit as shown in fig. is



A. 2A

B. $\frac{1}{3}A$

C. 1A

D. 1.5A

Answer: D

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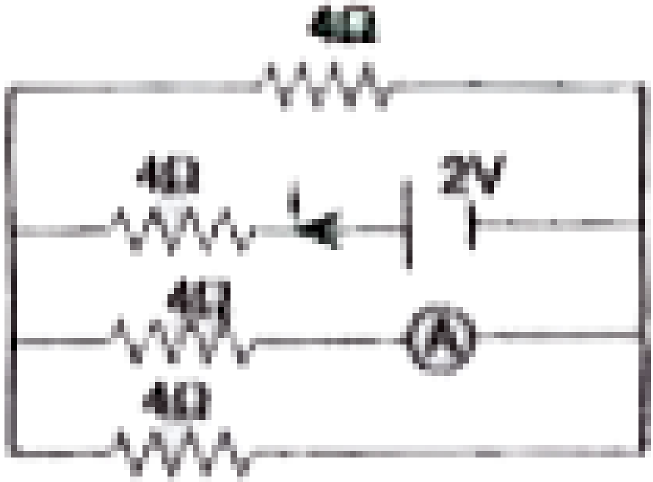
4. Current coming from the battery and ammeter reading are



A. $\frac{3}{8}A, \frac{1}{8}A$

B. $\frac{1}{8}A, \frac{1}{8}A$

C. $2A, \frac{2}{3}A$

D. $2A, \frac{1}{8}A$

Answer: A

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5. A uniform copper wire carries a current i amperes and has p carriers per metre^3. The length of the wire is 1 metro and its cross-section area is s metre^2. If the charge on a carrier is q coulombs, the drift velocity in ms^{-1} is given by

A. 1/lsq

B. i/psq

C. psq/i

D. i/pslq

Answer: B

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6. If a current of 0.5 apere flows through a metallic wire for 2 hour then how many electrons flow through the wire ?

A. $2:1$

B. $1:2$

C. $4:1$

D. $1:4$

Answer: B

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7. A copper wire of diameter 1 mm carries a current of 1.1A. The drift speed of electrons in (given, density of $Cu = 9g/cm^3$, atomic weight of Cu = 63 g and one electron is contributed by each Cu atom)

A. 0.1 mm/s

B. 0.2 mm/s

C. 0.3 mm/s

D. 0.2 cm/s

Answer: A

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PRACTICE SHEET (EXERCISE - I LEVEL-II (ADVANCED) (Straight Objective Type Questions))

1. When a current passes through a resistor, its temperature increases. Is it an adiabatic process?

A. may increase or decrease

B. remains constant

C. increases

D. decreases

Answer: C

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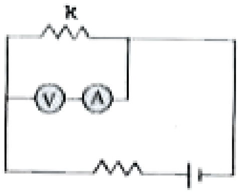
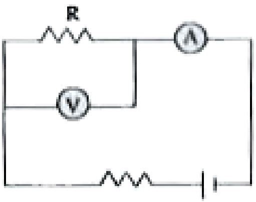
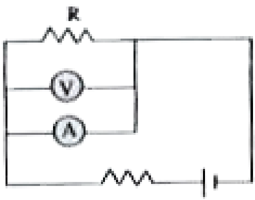
2. Which of the following diagrams could be used to experimentally determine R using ohm's law? Assume an ideal voltmeter and an ideal ammeter.



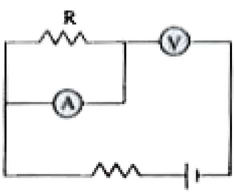
A.



B.



C.



D.

Answer: B

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3. Chose the correct statement:

A. Number of collisions per second between free electrons in a wire is a measure of electric resistance of the wire

B. When a finite current passes through a conductor, no heat can be dissipated in it

C. e.m.f can never be electrostatic in nature

D. An Ohmic resistor must obey Ohm.s law

Answer: B

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PRACTICE SHEET (EXERCISE - I LEVEL-II (ADVANCED) (More than One correct answer Type Questions))

1. Temperature dependence of drift velocity depends on the following factors.

A. Number of charge carriers can change with temperature

B. Time interval between two successive collisions can depend on the temperature

C. Length of a material is a function of temperature

D. Mass of a material is a function of temperature

Answer: A::B

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PRACTICE SHEET (EXERCISE - I LEVEL-II (ADVANCED) (Linked Comprehension Type Questions))

1. Passage-I :

Two large plates are located in vacuum. One of them serves as a cathode, a source of electrons whose initial velocity is negligible. An electron flow directed toward the opposite plate produces a space charge causing the potential in the gap between the plates to vary as $V = ax^{4/3}$, where a is a positive constant, and x is the distance from the cathode.

The electric field between the plate as a function of x is

A. $E = ax^{1/3}$

B. $E = -ax^{2/3}$

C. $E = \frac{-4a}{3}x^{1/3}$

D. None

Answer: C

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2. A proton is moving along the negative direction of X-axis in a magnetic field directed along the positive direction of Y-axis. The proton will be deflected along the negative direction of

A. $a \in_0 x^{1/3}$

B. $\frac{4}{9} a x^{1/3}$

C. $-\frac{4}{9} a \in_0 x^{-2/3}$

D. $\frac{4}{9} a \in_0 x^{4/3}$

Answer: C

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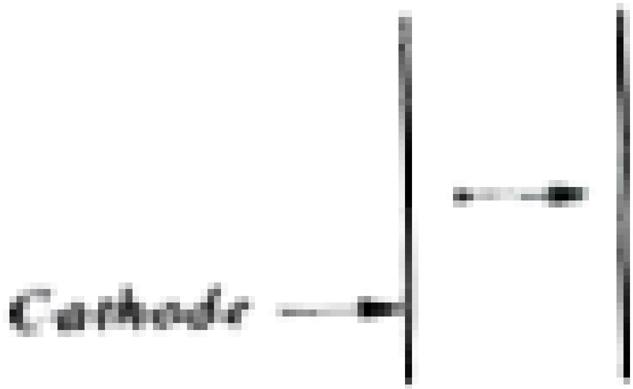
3. Passage-I :

Two large plates are located in vacuum. One of them serves as a cathode, a source of electrons whose initial velocity is negligible. An electron flow directed toward the opposite plate produces a space charge causing the potential in the gap between the plates to vary as $V = ax^{4/3}$, where a is a positive constant, and x is the distance from the cathode.



The current density

A. $-\frac{2}{3} \in_0 a^{3/2}\sqrt{\frac{2e}{m}}$

B. $-\frac{4}{9} \in_0 a^{3/2}\sqrt{\frac{2e}{m}}$

C. $-\frac{2}{3} \in_0 a^{3/2}\sqrt{\frac{2e}{m}}$

D. None.

Answer: B

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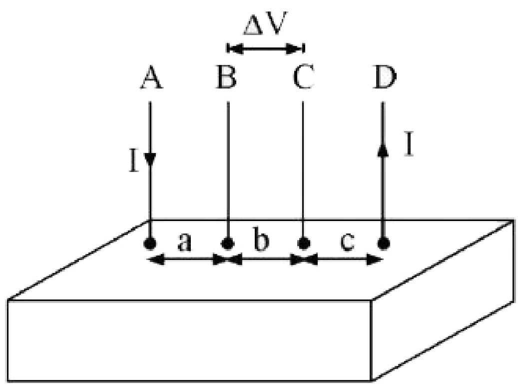
4. Consider a block of conducting material of resistivity p shown in the figure. Current I enters at A and leaves from D. We apply superposition principle to find voltage Δv developed between B and C. The calculation is done in the following steps :



(i) Take current I entering from A and assume it to spread over a hemispherical surface in the block.

(ii) Calculate filed E(r) at distance r from A by using Ohm's law $E = \pi$ where j is the current per unit area at r.

(iii) From the r dependence of E(r), obtain the potential V(r) at r.

(iv) Repeat (i), (ii) and (iii) for current I leaving D and superpose result for A and D.

Δvmeasured between B and C is :

A. $\frac{\rho l}{\pi a} - \frac{\rho l}{\pi(a+b)}$

B. $\frac{\rho l}{a} - \frac{\rho l}{(a+b)}$

C. $\frac{\rho l}{2\pi a} - \frac{\rho l}{2\pi(a+b)}$

D. $-\frac{\rho l}{2\pi(a-b)}$

Answer: C

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5. Passage-II:

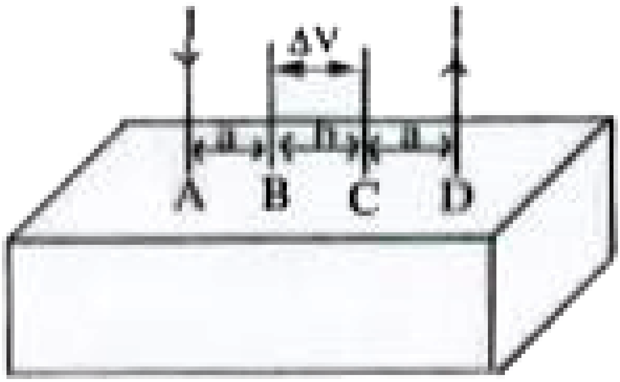
Consider a block conducting material of resistivity .ρ. shown in the figure. Current .I. enters at .A. and leaves from .D.. We apply superposition principle to find voltage .ΔV. developed between .B. and .C.. The calculation is done in the following steps :

i) Take current .I. entering from .A. and assume it to spread over a hemispherical surface in the block.

ii) Calculate field E(r) at distance .r. from A by using Ohm.s law $E = \rho j$, where j is the current per unit area at .r..

iii) From the .r. dependence of E(r), obtain the potential V(r) at r.

iv) Repeat (i), (ii), (iii) for current .I. leaving .D. and superpose results for .A. and .D..



For current entering at A the electric field at a distance

.r. from A is

A. $\dfrac{\rho I}{8\pi r^2}$

B. $\dfrac{\rho I}{r^2}$

C. $\dfrac{\rho I}{2\pi r^2}$

D. $\dfrac{\rho I}{4\pi r^2}$

Answer: C

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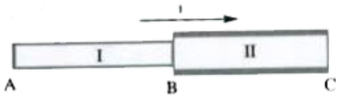
PRACTICE SHEET (EXERCISE - I LEVEL-II (ADVANCED) (Matrix Matching Type Questions))

1. Column - I gives physical quantities of a situation in which a current I passes through two rods I and II of equal length that are joined in series. The ratio of free electron density (n), resistivity (ρ) and corss - section area (A) of both are in ratio $n_1 : n_2 = 2 : 1$ and $A_1 : A_2 = 1 : 2$ respectively. Column II gives corresponding results. Match the ratios in the column I with the values in column II



COLUMN - I	COLUMN - II
A) $\dfrac{\text{Drift velocity of free electron in rod I}}{\text{Drift velocity of free electron in rod II}}$	p) 0.5
B) $\dfrac{\text{Electric field in rod I}}{\text{Electric field in rod II}}$	q) 1
C) $\dfrac{\text{potential difference across rod I}}{\text{potential differnce across rod II}}$	r) 2
D) $\dfrac{\text{Average time taken by free electron to move from A to B}}{\text{Average time taken by free electron to move from B to C}}$	s) 4

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PRACTICE SHEET (EXERCISE - I LEVEL-II (ADVANCED) (Integer Type Questions))

1. The area of cross-section, length and density of a piece of a metal of atomic weight 60 are $10^{-6}m^2, 1.0m$ and $5 \times 10^3 kg / m^3$ respectively, every atom contributes one free electron. (Given Avogadro number

$=6 \times 10^{23} / mol$). Find the drift velocity of electrons in the metal when the current of $16 A$ passes through:

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2. A straight copper-wire of length 1 = 1000 m and corss-sectional area A = 1.0 mm^2 carries a current i=4.5A. The sum of electric forces acting on all free electrons in the given wire is $M \times 10^6 N$. Find M. Free electron density and resistivity of copper are $8.5 \times 10^{28} / m^3$ and $1.7 \times 10^{-8} \Omega$.m respectively.

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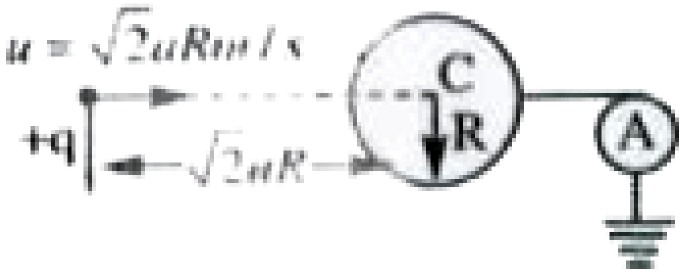
3. If a charge q is moving towards the centre of an earthed conducting sphere of radius R with a velocity $\sqrt{2}aR$ m/s. Where a is positive constant. If current flowing in the ammeter shown in figure when q is at a distance $aR\sqrt{2}$ from centre of sphere. Is $\frac{q}{a\sqrt{x}}$ find x.



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PRACTICE SHEET (EXERCISE - II LEVEL-I (MAIN) (Straight Objective Type Questions))

1. A copper wire of cross - sectional area 3.4 mm^2 and length of the wire 400m, specific resistivity of copper is $1.7 \times 10^{-8} \Omega - m$. Then the resistance of the wire is

A. 20Ω

B. 200Ω

C. 2Ω

D. $2k\Omega$

Answer: C

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2. Four wires made of same material have different lengths and radii, the wire having more resistance in the following case is

A. $l = 100cm, r = 1mm$

B. $l = 50cm, r = 2mm$

C. $l = 100cm, r = \frac{1}{2}mm$

D. $l = 50cm, r = \frac{1}{2}mm$

Answer: C

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3. The resistance of the series combination of two resistances is S. When they are joined in parallel, the total resistance is P. If S = nP, then the minimum possible value of n is :

A. 4

B. 1

C. 2

D. 3

Answer: A

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4. Three resistances 2Ω, 3Ω and 4Ω are connected in parallel. The ratio of currents passing through them when a potential difference is applied across its ends will be

A. $2:3:6$

B. $1:2:3$

C. $1:1:1$

D. $6:3:2$

Answer: D

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5. You are given several identical resisters each of value 5Ω and each capable of carrying a maximum current of 2A. It is required to make a suitable combination of these resistance to produce a resistance of 2.5Ω which can carry current of 4A. The minimum number of resistances required for this job is

A. 2

B. 4

C. 6

D. 8

Answer: A

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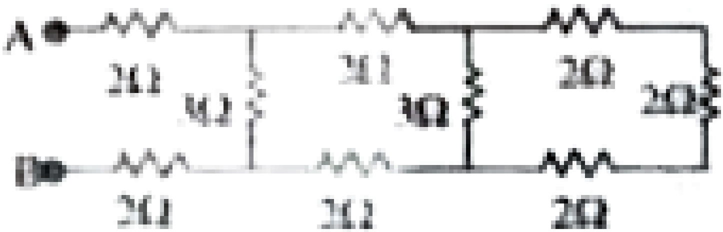
6. The effective resistance between A and B in the given circuit is



A. 20Ω

B. 7Ω

C. 3Ω

D. 6Ω

Answer: D

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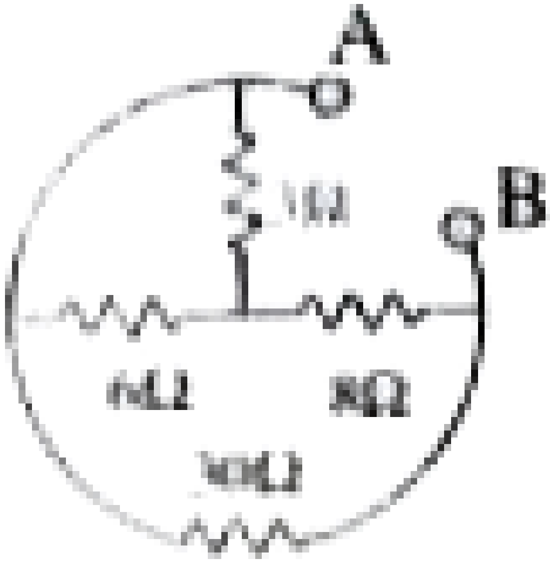
7. The effective resistance between A and B in the given circuit is



A. 1.5Ω

B. 7.5Ω

C. 4.7Ω

D. 12Ω

Answer: B

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8. The effective resistance between A and B in the given circuit is

A. 18Ω

B. 6Ω

C. 2Ω

D. 3Ω

Answer: C

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9. A hollow cylinder $\left(\rho = 2.2 \times 10^{-8}\Omega - m\right)$ of length 3 m has inner and outer diameters are 2 mm and 4 mm respectively. The resistance of the cylinder is

A. $0.35 \times 10^{-3}\Omega$

B. $3 \times 10^{-3}\Omega$

C. $7 \times 10^{-3}\Omega$

D. $3.1 \times 10^{-3}\Omega$

Answer: C

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10. A metal block has lengths 50 cm, breadth 30cm and thickness 20cm. When current passes through it parallel to its length and parallel to its breadth, the ratio of maximum to minimum resistance of that block is

A. $4:25$

B. $25:4$

C. $25:9$

D. $9:25$

Answer: C

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11. Two wires of same dimension but resistivity p_1 and p_2 are connected in series. The equivalent resistivity of the combination is

A. $\dfrac{\rho_1 X_1 + \rho_2 X_2}{X_1 + X_2}$

B. $\dfrac{\rho_1 X_2 + \rho_2 X_1}{X_1 - X_2}$

C. $\dfrac{\rho_1 X_2 + \rho_2 X_1}{X_1 + X_2}$

D. $\dfrac{\rho_1 X_1 + \rho_2 X_2}{X_1 - X_2}$

Answer: A

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12. The temperature coefficient of resistivity of material is 0.0004/k. When the temperature of the material is increased by $50^{\circ}C$, its resistivity increases by 2×10^{-8} ohm-m. The initial resistivity of the material in ohm-m is

A. 50×10^{-8}

B. 90×10^{-8}

C. 100×10^{-8}

D. 200×10^{-8}

Answer: C

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13. The resistance of a bulb filamanet is 100Ω at a temperature of $100^\circ C$. If its temperature coefficient of resistance be $0.005 per.^\circ C$, its resistance will become 200Ω at a temperature of

A. $300^0 C$

B. $400^0 C$

C. $500^0 C$

D. $200^0 C$

Answer: B

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14. This quesiton contains Statement-1 and Statement-2. Of the four choices given after the statement, choose the one that best describes the two statements.

Statement-1 : The temperature dependence of resistance is usually given as $R = R_0(1 + \alpha \Delta t)$. The resistance of a wire changes from 100Ω to 150Ω when its temperture is increased from $27^\circ C$ to $227^\circ C$. This implies that $\alpha = 2.5 \times 10^{-3} / .^\circ C$.

Statement -2 : $R = R_1(1 + \alpha \Delta T)$ is valid only when the change in the temperature ΔT is small and $\delta R = (R - R_0) < < R_0$

A. Statement-1 is true, statement-2 is true, Statement-2 is the correct explanation of statement-1.

B. Statement-1 is true, statement-2 is true, Statement-2 is not the correct explanation of statement-1.

C. Statement-1 is false, Statement-2 is true

D. Statement-1 is true, Statement-2 is false

Answer: D

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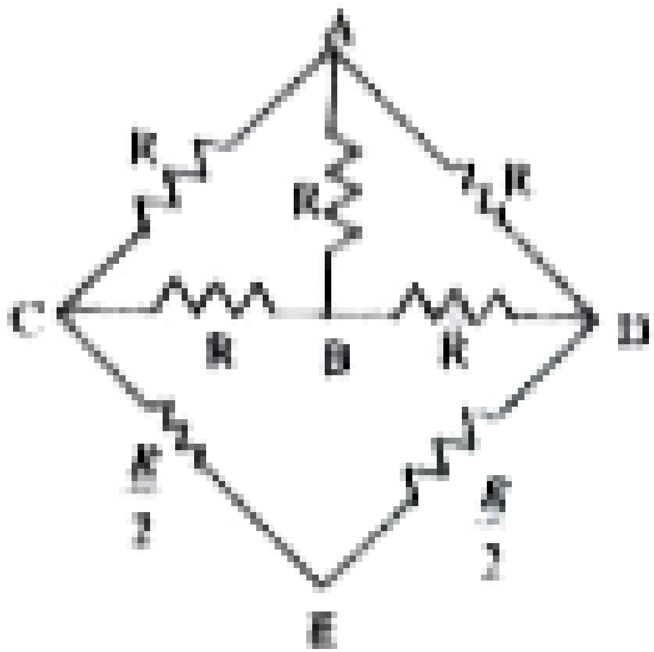
PRACTICE SHEET (EXERCISE - II LEVEL-II (ADVANCED) (More than One correct answer Type Questions))

1. The adjacent figure shows a resistance network with value of each resistance is R. The equivalent resistance across .A and B., .A and C. and .C and B. are R_{AB}, R_{AC} and R_{CB} respectively then



A. $R_{AB} = R_{AC} = R_{CB}$

B. $R_{AB} = 2R_{AC}$

C. $R_{AB} = R_{CB}$

D. $R_{AB} = \frac{R}{2}$

Answer: A::C::D

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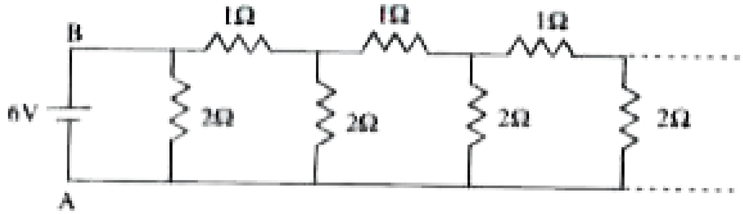
2. An infinite ladder network of resistances is constructed with 1Ω and 2Ω resistances as shown



A. Effective resistance between A & B is 2Ω

B. Effective resistance between A & B is 1Ω

C. Current through 2Ω resistor nearest to battery is 6A

D. Current through 2Ω resistor nearest to battery is 3A

Answer: B::C

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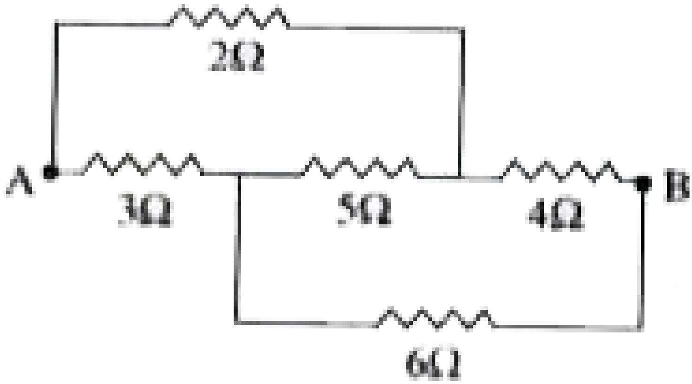
3. In the circuit shown some potential difference is applied between A and B. The equivalent resistance between A and B is R. Then



A. no current flows through 5Ω resistor

B. $R = 15\Omega$

C. $R = 12.5\Omega$

D. $R = \frac{18}{5}\Omega$

Answer: A::D

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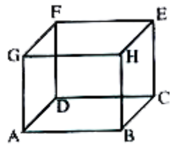
PRACTICE SHEET (EXERCISE - II LEVEL-II (ADVANCED) (Matrix matching Type Questions))

1. Wires each of resistance R form a cubical wire frame as shown in figure. Match the following.

COLUMN-I	COLUMN-II
A) Resistance across AB	p) $\frac{5R}{6}$
B) Resistance across AC	q) $\frac{7R}{12}$
C) Resistance across AE	r) $\frac{3R}{4}$
D) Resistance across AB, if the wire AB is removed	s) $\frac{7R}{5}$



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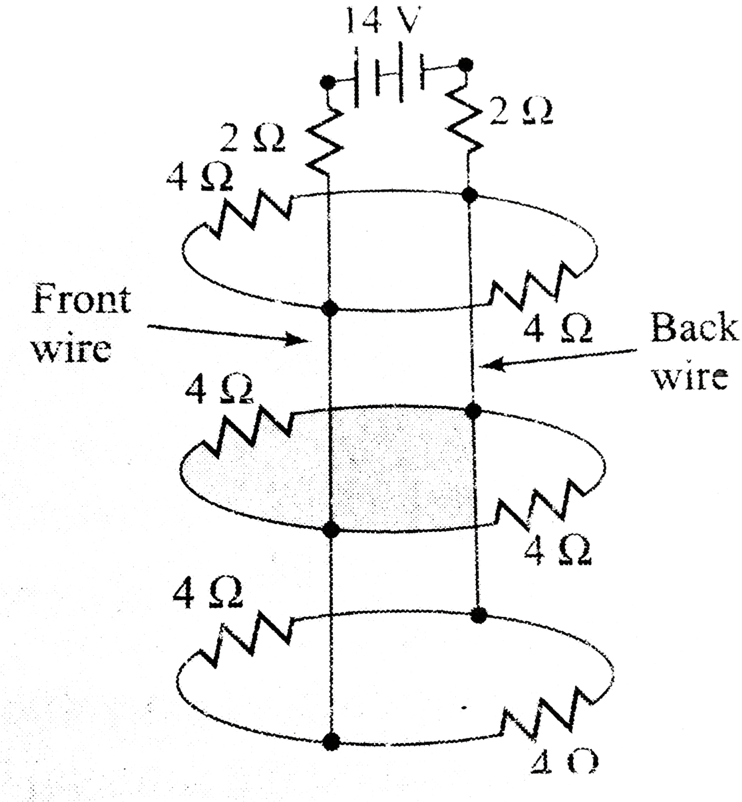
PRACTICE SHEET (EXERCISE - II LEVEL-II (ADVANCED) (Integer Type Questions))

1. Find the current supplied by the source in fig. The resistors are mounted around in a cylindrical form.



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2. The resistance of a wire is 5Ω at $50^{\circ} C$ at 6Ω at 100.

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PRACTICE SHEET (EXERCISE - III LEVEL-I (MAIN) (Straight Objective Type Questions))

1. A 50V battery is connected across a 10 ohm resistor. The current is 4.5A is flowing through the resistor then the internal resistance of the battery is

A. zero

B. 0.5Ω

C. 1.1Ω

D. 5Ω

Answer: C

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2. A cell whose e.m.f. is 2V and internal resistance is 0.1Ω is connected with a resistance of 3.9Ω the voltage across the cell terminal will be

A. 0.5 V

B. 1.9 V

C. 1.95 V

D. 72 V

Answer: C

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3. The emf of a daniel cell is 1.08V. When the terminals of the cell are connected to resistance of 3Ω, the potential difference across the terminals is found to be 0.6 V. Then , the internal resistance of the cell is

A. 1.8Ω

B. 2.4Ω

C. 3.24Ω

D. 0.2Ω

Answer: B

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4. A student is asked to connected four cells of e.m.f of 1 V and internal resistance 0.5 ohm in series with a external resistance of 1 ohm. But one cell is wrongly connected by him with its terminal reversed, the current in the circuit is

A. $\frac{1}{3}A$

B. $\frac{2}{3}A$

C. $\frac{3}{4}A$

D. $\frac{4}{3}A$

Answer: B

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5. When two identical cells are connected either in series or in parallel across a 4 ohm resistor, they send the same current through it. The internal resistance of the cell in ohm is

A. 1.2

B. 2

C. 4

D. 4.8

Answer: C

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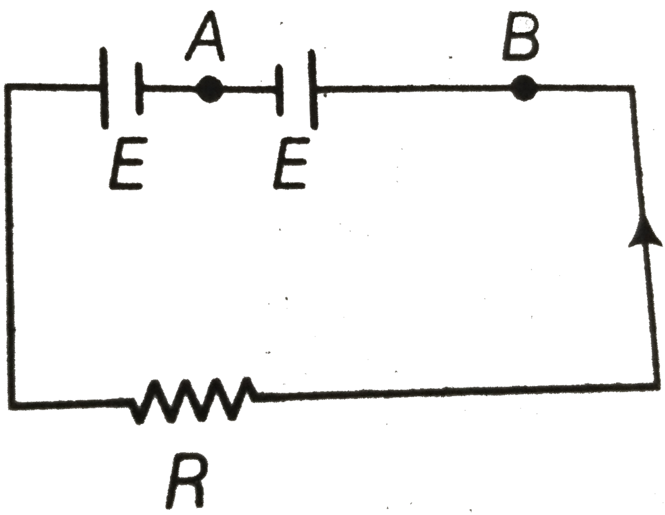
6. 

Two cells of same emf E but internal resistance r_1 and r_2 are connected in series to an external resistor R(figure). What should be the value of R so that the potential difference across the terminals of the first cell becomes zero?

A. $\sqrt{r_1 r_2}$

B. $r_1 + r_2$

C. $r_1 - r_2$

D. $\frac{r_1 + r_2}{2}$

Answer: C

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7. the current in a circuit containing a battery connected to 2Ω resistance is $0.9A$. When ana additional resistance of 8Ω is connected to the same battery the current observed in the circuit is $0.3A$. Then the internal resistance of the battery is $x\Omega$. Find value of x.

A. 0.1Ω

B. 0.5Ω

C. 1Ω

D. zero

Answer: B

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8. A 6 V cell with 0.5Ω internal resistance , a 10 v cell with 1Ω internal resistance and a 12Ω external resistance are connected in parallel . The current (in amper) through the 10 V cell is

A. 0.6

B. 2.27

C. 2.87

D. 5.14

Answer: C

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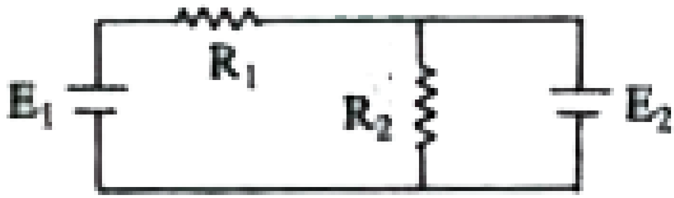
9. Two cells of emf E_1 and E_2 are connected to two resistors R_1 and R_2 as shown. If E_2 is short circuited then current through R_1 and R_2 are



A. $\frac{E_1}{E_2}, 0$

B. $0, \frac{E_1}{R_2}$

C. $\frac{E_1}{R_1}, 0$

D. $0, \frac{E_1}{R_1}$

Answer: C

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10. When two cells of different emf's are connected in series to an external resistance the current is 5A. When the poles of one cell are interchanged, the current is 3A. The ratio of emf's of two cell is

A. $2:1$

B. $1:3$

C. $5:1$

D. $4:1$

Answer: D

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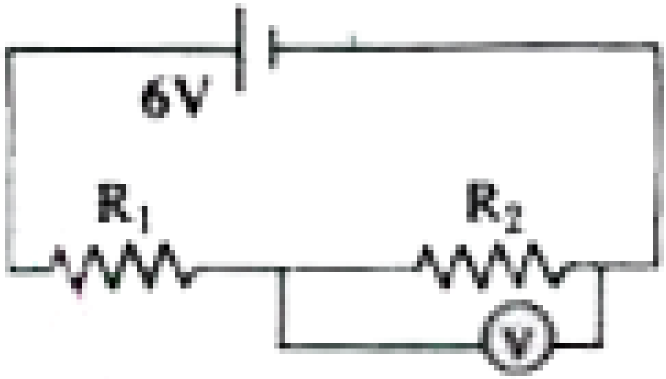
11. In the circuit $R_1 = 400$ ohm and $R_2 = 200$ ohm. If the resistance of the voltmeter R = 10,000 ohm, voltmeter reading is



A. 2V

B. greater

C. greater than 3V

D. less than 2V

Answer: D

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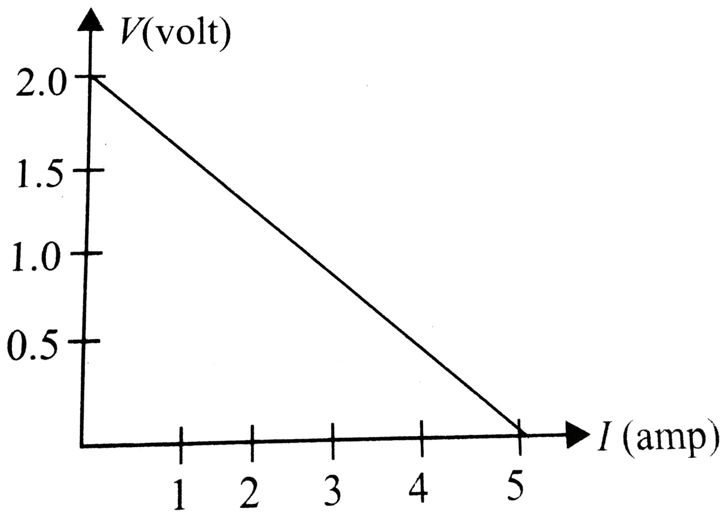
12. For a cell, a graph is plotted between the potential difference V across the terminals of the cell and the current I drawn the cell. The emf and the internal resistance of the cell are E and r, respectively. Then



A. $E = 2V, r = 0.5\Omega$

B. $E = 2V, r = 0.4\Omega$

C. $E > 2V, r = 0.5\Omega$

D. $E > 2V, r = 0.4\Omega$

Answer: B

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13. How many cells each marked $(6V - 12A)$ should be connected in mixed grouping so that it may be marked $(24V - 24A)$

A. 4

B. 8

C. 12

D. 6

Answer: B

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14. Find the minimum number of cells required to produce an electric current of 1.5 A through a resistance of 30Ω. Given that the emf of each cell is 1.5 V and internal resistance 1.0Ω.

A. 30

B. 120

C. 40

D. 60

Answer: B

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15. Three equal resistance each of 3Ω are in series and connected to cell of internal resistance one ohm. If three resistances are parallel and connected to the same cell. Then the ratio of the respective currents through the electric circuits in the two cases is

A. $1/8$

B. $1/7$

C. $1/5$

D. $1/3$

Answer: C

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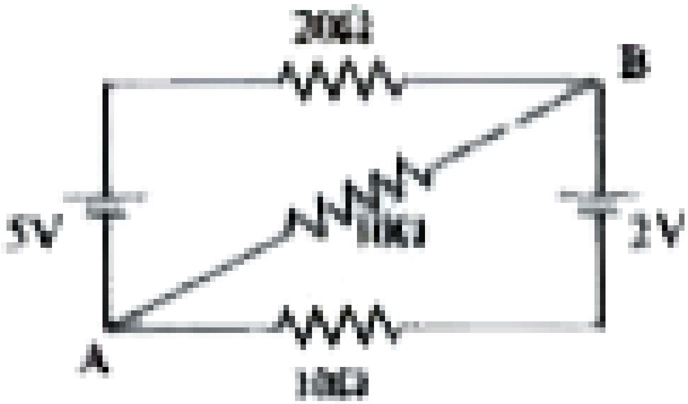
16. The P.d between the terminals A&B is _____



A. 2V

B. 3V

C. 3.6V

D. 1.8V

Answer: D

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PRACTICE SHEET (EXERCISE - III LEVEL-II (ADVANCED) (More than One correct answer Type Questions))

1. Choose the correct statement from the following

A. If n identical cells, each of emf E and internal resistance r are connected in series, the emf of combination in nE and the internal resistance of the combination is nr.

B. If n identical cells, each of emf E and internal resistance r are connected in parallel, the emf of the combination is E/n and the internal resistance of the combination is r/n

C. Cells should be connected in series, if the external resistance R is greater than internal resistance r

D. Cells should be connected in parallel if R is smaller than r

Answer: A::C::D

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2. 24 cells, each of emf 1.5V and internal resistance is 2Ω connected to 12Ω series external resistance. Then,

A. in order to send the maximum current through a 12Ω resistor, connect the two rows of 12 cells in series

B. the current is each row is $0.375A$

C. the current in each cell is 0.75A

D. potential difference across 12Ω resistor is 4.5V

Answer: A::B

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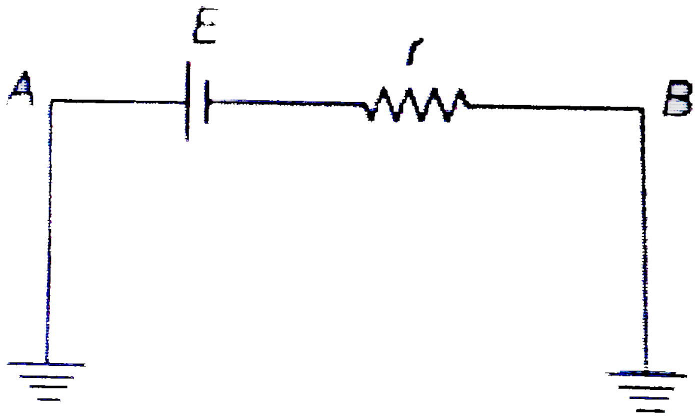
3. Both terminals of a battery of emf E and internal resistance r are grounded as shown. Select the correct alternative(s).



A. Potential difference across A and B is Zero

B. Potential difference across A and B is E.

C. Current through the battery is zero

D. Current through the battery is $\frac{E}{r}$

Answer: A::D

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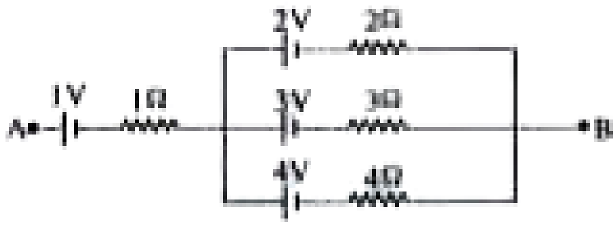
PRACTICE SHEET (EXERCISE - III LEVEL-II (ADVANCED) (Linked Comprehension Type Questions))

1. Passage :



From the above circuit, the equivalent emf between the terminals A and B is

A. $\frac{49}{13}V$

B. $\frac{36}{13}V$

C. $\frac{37}{13}V$

D. $\frac{24}{13}V$

Answer: A

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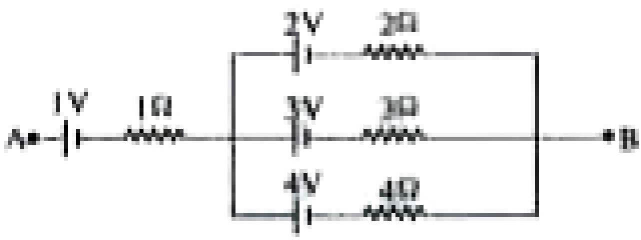
2. Passage :



From the above circuit, equivalent internal resistance of the combination is

A. $\frac{13}{12}\Omega$

B. $\frac{25}{13}\Omega$

C. $\frac{13}{24}\Omega$

D. $\frac{24}{13}\Omega$

Answer: B

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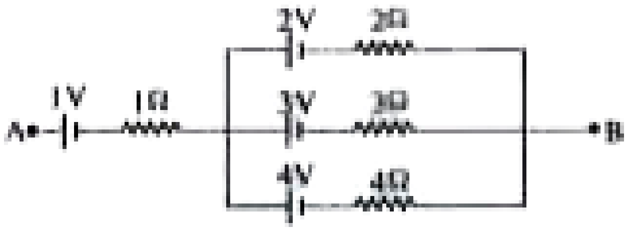
3. Passage :



If the polarity of cell of 4V is reversed, the equivalent and between the terminals A and B is

A. $\frac{12}{13}V$

B. $\frac{25}{13}V$

C. $\frac{37}{13}V$

D. $\frac{1}{13}V$

Answer: B

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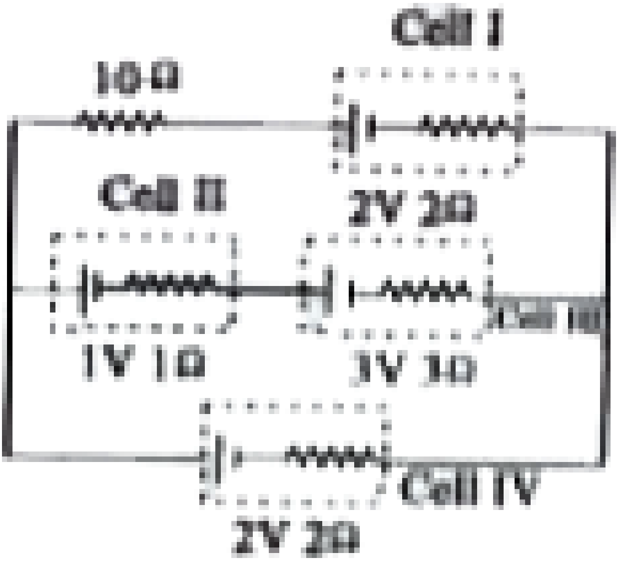
PRACTICE SHEET (EXERCISE - III LEVEL-II (ADVANCED) (Matching Type Questions))

1. For the circuit shown in fig. 4 cells are arranged.



In Column-I, the cell number is given while in Column-II, some statements related to cells are given. Match the entries of Column-I with the entries of Column-II.

COLUMN-I	COLUMN-II
A) Cell I	p) Chemical energy of cell is decreasing
B) Cell II	q) Chemical energy of cell is increasing
C) Cell III	r) Work done by cell is +Ve
D) Cell IV	s) Thermal energy developed in cell is +Ve

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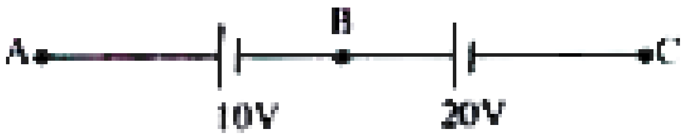
PRACTICE SHEET (EXERCISE - III LEVEL-II (ADVANCED) (Integer Type Questions))

1. Cells of emfs 10V and 20V are connected as shown. When an ammeter is connected across A and B its reads 1A, when connected across B and C it reads 5, when connected across A and C it reads 3A, find the resistance of the ammeter (in Ω)



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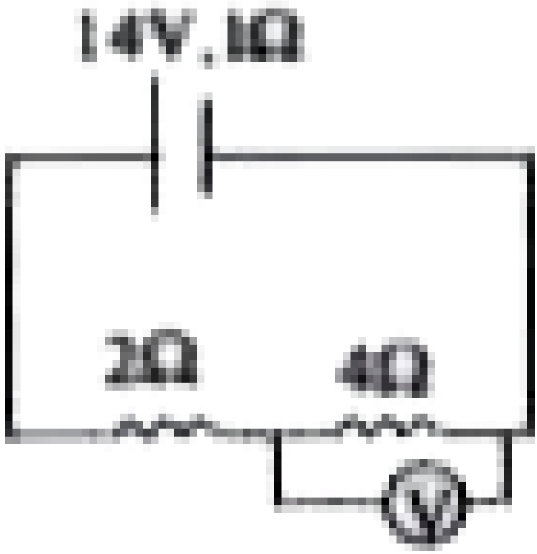
2. Voltmeter reading in the given circuit is (voltmeter is ideal



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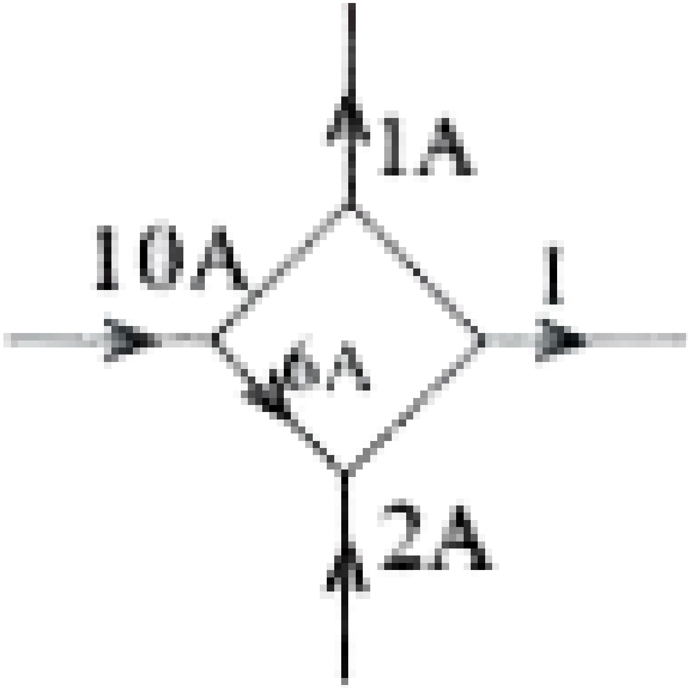
PRACTICE SHEET (EXERCISE - IV LEVEL-I (MAIN) (Straight Objective Type Questions))

1. The value of current I, in the figure shown will be



A. 11A

B. 19A

C. 13A

D. 9A

Answer: A

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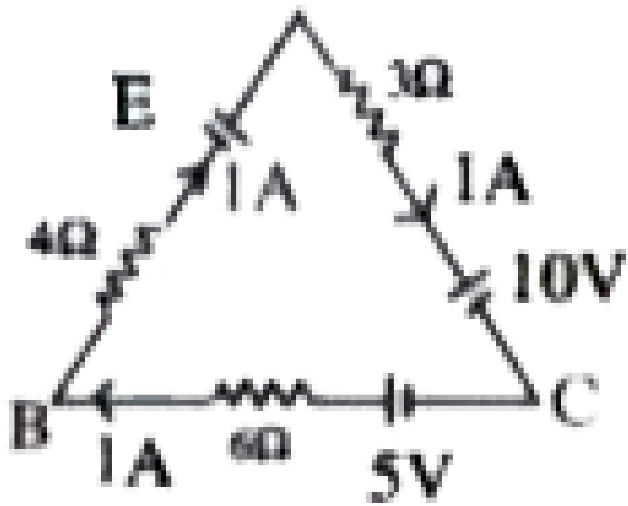
2. Find E for the Given Loop



A. -24v

B. 18v

C. 4v

D. 0v

Answer: B

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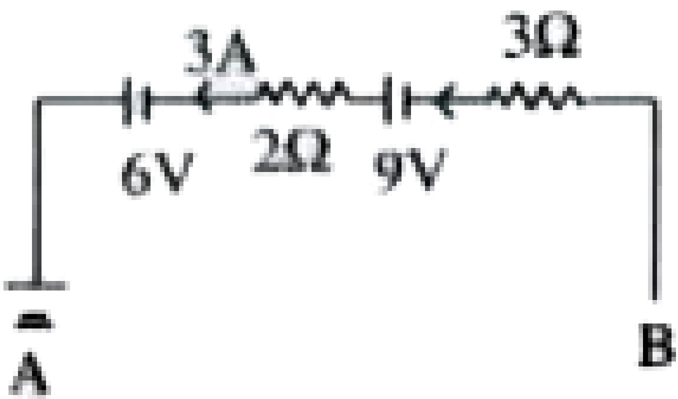
3. The potential difference between points A and B is



A. 10v

B. 12v

C. 14v

D. 0v

Answer: D

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4. Four resistors A, and D form a Wheatstone bridge. The bridge is balanced , when C = 100Ω If A and B are interchanged the bridge balances for $C = 121\Omega$. The value of D is

A. 100Ω

B. 200Ω

C. 300Ω

D. 110Ω

Answer: D

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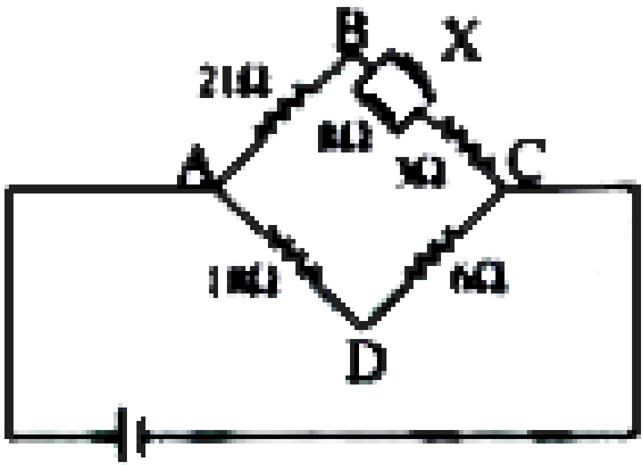
5. In the circuit shown in the figure, the value of Resistance X, when potential difference between the point B and D is zero will be



A. 9Ω

B. 8Ω

C. 6Ω

D. 4Ω

Answer: B

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6. A 6Ω resistance is connected in the left gap of a meter bridge. In the second gap 3Ω and 6Ω are joined in parallel. The balance point of the bridge is at ______

A. 75 cm

B. 60 cm

C. 30 cm

D. 25 cm

Answer: A

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7. When un known resistance and a resistance of 4Ω are used in the left and right gaps of a meter bridge, the balance point is 50cm. the shift in the balance point if a 4Ω resistance is now connected parallel to the resistor in right gap ______

A. $\frac{100}{3}cm$

B. $\frac{50}{3}cm$

C. $\frac{300}{3}cm$

D. $\frac{400}{5}cm$

Answer: B

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8. When a conducting wire is connected in the left gap and known resistance in the right gap, the balance length is 75cm. If the wire is cut into 3 equal parts and one part isconnected in the left gap, the balance length

A. shifts left by 25cms

B. shifts right by 25cms

C. shifts left by 50cms

D. shifts right by 50cms

Answer: A

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9. When a metal conductor connected to left gap of a meter bridge is heated, the balancing point

A. 50cm

B. 80cm

C. 40cm

D. 70cm

Answer: A

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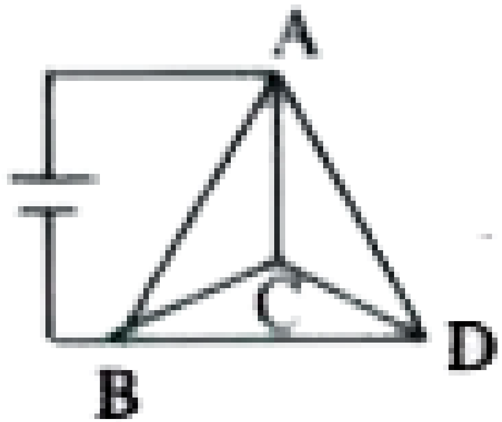
10. A tetrahedral is consisting of 6 identical wires as shown in figure. Each wire is having a resistance of 2Ω. When an ideal cell of emf 2V is connected across AB, as shown then the current through CD is



A. 1A

B. $\dfrac{6}{19}A$

C. 4A

D. Zero

Answer: D

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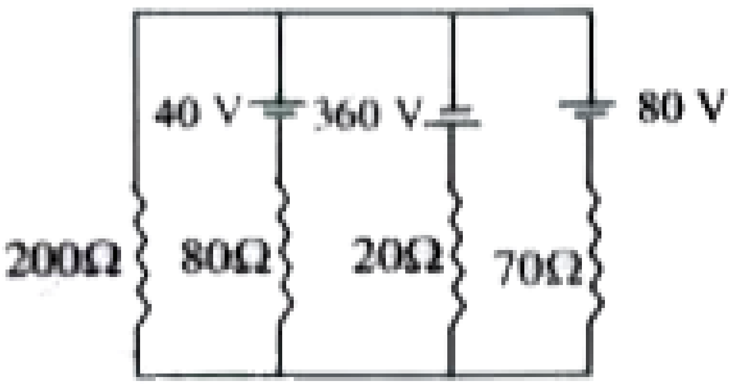
PRACTICE SHEET (EXERCISE - IV LEVEL-II (ADVANCED) (More than One correct answer Type Questions))

1. Consider the given DC circuit.



A. current in 70Ω resistance is 4A

B. Current in 80Ω resistance is 5A

C. potential drop across 200Ω resistance is 200V

D. current through 200Ω resistor is 0.5A

Answer: A::C

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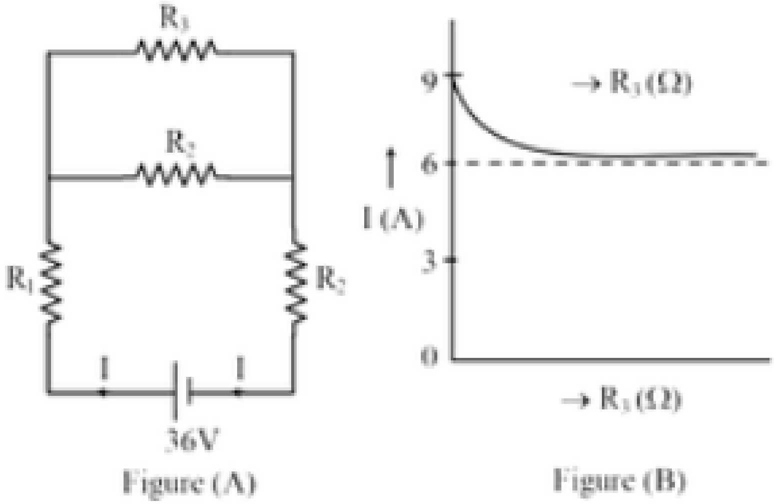
2. In the circuit shown in the figure (A), R_3 is a variable resistance. As the value R_3 is changed, the current I through the cell varies as shown in the figure (B). As $R_3 \to \infty$, the current I $\to$ 6 A. What is the value. of the sum of the resistances R_1 and R_2 in ohms?



A. $R_1 = 2$

B. $R_2 = 2$

C. $R_1 = 3$

D. $R_2 = 4$

Answer: A::B

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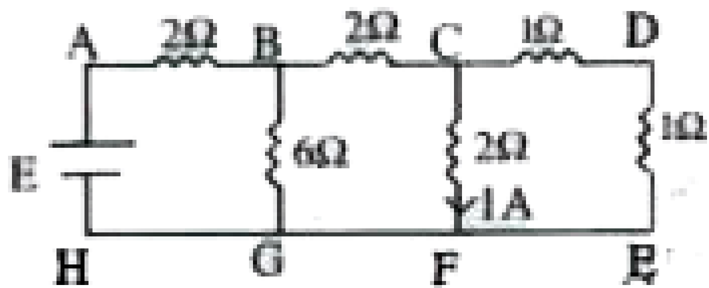
PRACTICE SHEET (EXERCISE - IV LEVEL-II (ADVANCED) (Linked Comprehension Type Questions))

1. Passage:

The figure shows a network of resistors and a battery. If 1A current flows thorugh the branch CF, then answer the following questions



The current through

A. branch DE is 1A

B. branch BC is 2A

C. branch BG is 4A

D. branch HG is 6A

Answer: A::B

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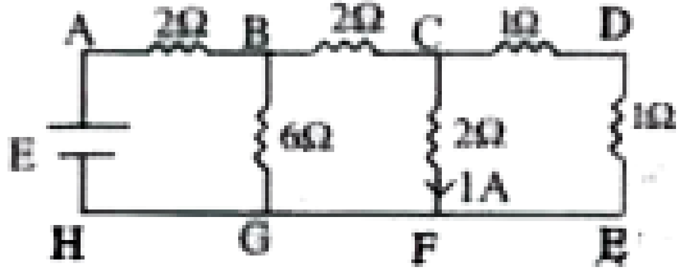
2. Passage:

The figure shows a network of resistors and a battery. If 1A current flows thorugh the branch CF, then answer the following questions



The emf E of the battery is

A. 24V

B. 12V

C. 18V

D. 6V

Answer: B

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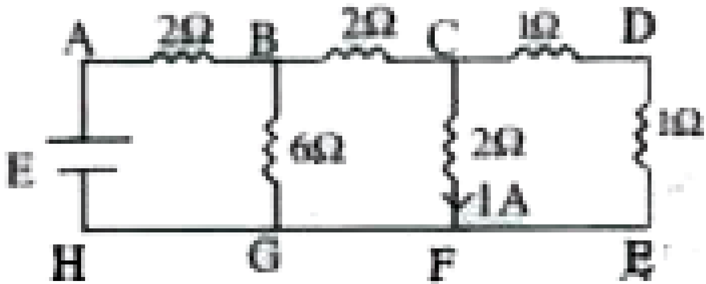
3. Passage:

The figure shows a network of resistors and a battery. If 1A current flows thorugh the branch CF, then answer the following questions



The current through

A. branch DE is zero

B. branch BC is zero

C. branch BG is 0.5A

D. branch AB is 1.5A

Answer: A

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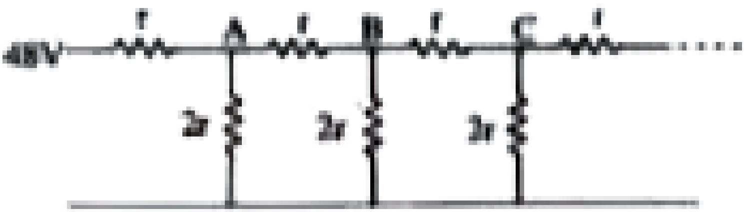
PRACTICE SHEET (EXERCISE - IV LEVEL-II (ADVANCED) (Integer Type Questions))

1. At the end of the infinite network shown, 48V is applied. What is the voltage at C in volts?



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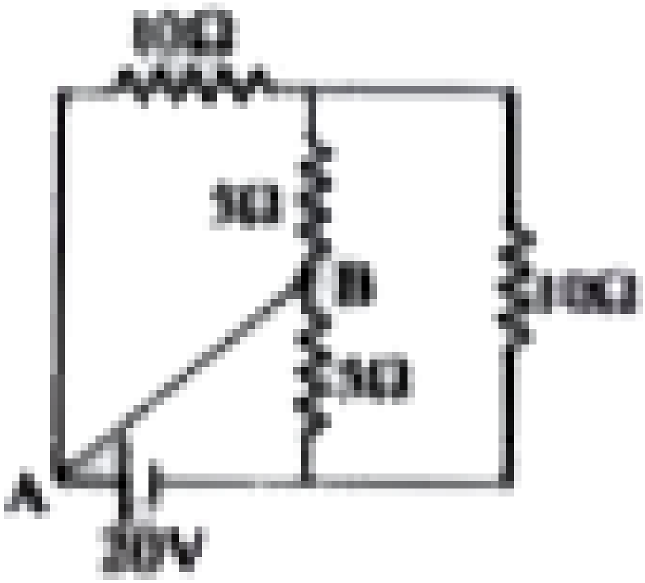
2. Find the current in amperes in the branch AB in the circuit shown in the figure.



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PRACTICE SHEET (EXERCISE - V LEVEL-I (MAIN) (Straight Objective Type Questions))

1. The emf of a battery A is balanced by a length of 80cm on a potentio meter wire. The emf of a standard cell 1v is balanced by 50cm. The emf of A is

A. 2v

B. 1.4v

C. 1.5v

D. 1.6v

Answer: D

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2. The balancing lengths of potentiometer wire are 800 cm and 600cm when two cells of emf's E_1 and E_2 are connected in the secondary circuit first in series and then terminals of one cell is reversed, $\frac{E_1}{E_2}$ is equal to

A. $1/11$

B. $14/11$

C. $7/1$

D. $4/3$

Answer: C

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3. When 6 identical cells of no internal resistance are connected in series in the secondarycircuit of a potentio meter, the balancing lengths is .l., balancing length becomes 1/3 when some cells are connected wrongly, the number of cells connected wrongly are

A. 1

B. 3

C. 2

D. 4

Answer: C

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4. A battery of unknown emf connected to a potentiometer has balancing length 560 cm. If a resistor of resistance 10 ohm, is connected in parallel with the cell the balancing length change by 60 cm. If the internal resistance of the cell is $\frac{n}{10}$ ohm, the value of 'n' is

A. 3.6

B. 2.4

C. 1.2

D. 0.6

Answer: C

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5. The resistivity of a potentiometer wire is, if the area of cross section of the wire is $4cm^2$. The current flowing in the circuit is 1A, the potential gradient is 7.5 v/m ______

A. $3 \times 10^{-3} \Omega - m$

B. $2 \times 10^{-6} \Omega - m$

C. $4 \times 10^{-2} \Omega - m$

D. $5 \times 10^{-4} \Omega - m$

Answer: A

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6. The length of potentiometer wire is 200 cm and the emf of standard cell is primary circuit is E volts. It is employed to a battery of emf 0.4 v the balance point is obtained at l = 40 cm from positive end, the E of the battery is (cell in primary is ideal and series resistance is zone

A. 4v

B. 2v

C. 5v

D. 7v

Answer: B

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7. The emf of a cell is 2V and its internal resistance is 2 ohm. A resistance of 8 ohm is joined to battery in parallel. This is contacted in secondary circuit of potentio meter. If IV standard cell balances for 100cm of potentiometer wire, the balance point of above cell is

A. 120cm

B. 240cm

C. 160cm

D. 116cm

Answer: C

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8. A galvanometer has coil of resistance 50Ω and shows full deflection at $100\mu A$. The resistance to be added for the galvanometer to work as an ammeter of range 10mA is nearly

A. 0.5Ω in series

B. 0.5Ω in parallel

C. 5.0Ω series

D. 5.0Ω in parallel

Answer: B

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9. A galvanometer of resistance 1000Ω gives full-scale deflection for a current of 1mA. To measure a P.D of 10V, the resistance to be connected with the galvanometer is

A. $9k\Omega$ in series

B. $9k\Omega$ is parallel

C. $10k\Omega$ in series

D. $1k\Omega$ parallel.

Answer: A

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10. A galvanometer of 25 ohm resistance can read a maximum current of 6mA. It can be used as a voltmeter to measure maximum potential difference of 6V by connecting a resistance to galvanometer. Identify the correct choice from the following

A. 1025Ω in series

B. 1025Ω is parallel

C. 975Ω is series

D. 975Ω in parallel

Answer: C

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11. A galvanometer has a current range of 15mA and voltage range of 750mv. To convert this galvanometer into an ammeter of range 25A, the sunt resistance required is nearly

A. 0.2Ω

B. 0.02Ω

C. 0.03Ω

D. 0.5Ω

Answer: B

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12. If a current of 0.5 apere flows through a metallic wire for 2 hour then how many electrons flow through the wire ?

A. $12.5 \mu A$

B. $12.5 mA$

C. $12.5 \times 10^{-7} A$

D. $12.5 \times 10^{-3} mA$

Answer: A

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13. two galvanometers of resistance 100Ω and 50Ω, are $10^{-8} A / \text{div}$ and 2×10^{-5}A/div respectively. In which case the voltage sensitivity is more ?

A. more in case I

B. more in case II

C. same in both cases

D. can.t say

Answer: A

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14. When 0.005A current flows through a moving coil galvanometer, it gives fullscale deflection. It is converted into a voltmeter to read 5 Volt, using an external resistance of 975Ω. The resistance of galvanometer in ohms is

A. 5

B. 10

C. 15

D. 25

Answer: D

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15. A galvanometer of resistance 40Ω and current passing through it is $100\mu A$ per divison. The full scale has 50 divisions. If it is converted into an ammeter of range 2A by using a shunt, then the resistance of ammeter is

A. $\frac{40}{399}\Omega$

B. $\frac{4}{399}\Omega$

C. 0.01Ω

D. 0.4Ω

Answer: A

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16. In the process of electroplating m gram of silver is deposited when 4 amp of current flows for 2 min The amount in (gm) of silver deposited by 6 amp of current flowing for 40 second will be

A. 10

B. 8

C. 6

D. 4

Answer: C

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17. The weight of a body at earth's surface is W. At a depth half way to the centre of earth it will weight

A. 4l

B. l/4

C. 2l

D. l/2

Answer: A

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18. In an experiment for calibration of voltmeter, a standard cell of emf 1.5V is balanced at 300cm length of potentiometer wire. The P.D across a resistance in the circuit is balancedat 1.25m. If a voltmeter is connected across the same resistance. It reads 0.65V. The errorin the volt meter is

A. 0.05V

B. 0.025V

C. 0.5V

D. 0.25V

Answer: B

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19. A potentiometer wire of length 10m and resistance 30 ohm is connected in series with a battery of emf 2.5V, internal resistance 5 ohm and external resistance R. If the fall of potential along the potentiometer wire is 50mV/m, the value of R is ohms is

A. 115

B. 80

C. 50

D. 100

Answer: A

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PRACTICE SHEET (EXERCISE - V LEVEL-II (ADVANCED) (Straight Objective Type Questions))

1. A galvanometer having a resistance of 50Ω , gives a full scale deflection for a current if 0.05 A. The length in metre if a resistance wire of area of cross- section $2.97 \times 10^{-2} cm^2$ that can be used to convert the gaivanometer into an ammeter which can read a maximum of 5 A current is (specific resistance of the wire =$5 \times 10^{-7} \Omega - m$)

A. 9

B. 6

C. 3

D. 1.5

Answer: C

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2. A galvanometer has a resistance G and current I_a flowing in it. Produces full scale deflection. If S_1 is the value of shunt which converts it into an ammeter of range 0-0i and S_2 is the value of the shunt for the range 0.2 i, then the ratio $\frac{S_1}{S_2}$ will be:

A. $\frac{1}{2}\left(\frac{I-I_g}{2I-I_g}\right)$

B. $\frac{2I-I_g}{I-I_g}$

C. $1/2$

D. 2

Answer: B

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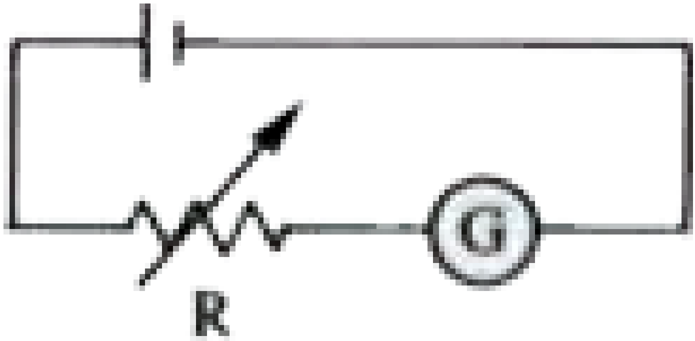
3. Deflection of galvanometer in the circuit is 71 divisions. A shunt of 15Ω is connected parallel to galvanometer and value of R is adjusted such that main current ramains the same. If the deflection in the galvanometer falls to 15 divisions then the resistance G of galvanometer in (in ohm)



A. $\frac{112}{3}$

B. 40

C. 56

D. $\frac{142}{3}$

Answer: C

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4. The deflection of a galvanometer falls to $1/10^{th}$ when a resistance of 5Ω is connected in parallel with it. If an additional resistance of 2Ω is connected in parallel to the galvanometer, the deflection is

A. $\frac{1}{6}$ th

B. $\frac{1}{16}th$

C. $\frac{2}{65}th$

D. $\frac{3}{36}$th

Answer: C

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PRACTICE SHEET (EXERCISE - V LEVEL-II (ADVANCED) (More than One correct answer Type Questions))

1. Mark out the correct options.

A. An ammeter should have small resistance

B. An ammeter should have large resistance

C. A voltmeter should have small resistance

D. A voltmeter should have large resistance

Answer: A::D

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2. An ammeter has a resistance of 50Ω and a full scale deflection current $50\mu A$. It can be used as a voltmeter or as a higher range ammeter provided that a resistance is added to it. Which of the following is/are true?

A. 10 V range with approximately $200k\Omega$ resistance in series

B. 30 V range with approximately $200k\Omega$ resistance in series

C. 1 mA range with 50Ω resistance in parallel

D. 0.1 mA range with 50Ω resistance in parallel

Answer: A::D

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3. Which of the following statements is/are correct for potentiometer circuit ?

A. Sensitivity varies inversely with the length of the potentiometer wire

B. Sensitivity is directly proportional to the potential difference applied across the potentiometer wire

C. Accuracy of a potentiometer can be increased only by increasing the length of wire

D. Range of the voltages to be measured depends upon the potential difference applied across the potentiometer wire

Answer: C::D

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PRACTICE SHEET (EXERCISE - V LEVEL-II (ADVANCED) (Integer Type Questions))

1. In meter bridge when P is kept in left gap, Q is kept in right gap, the balancing length is 40cm. If Q is shunted by 10Ω, the balance point shifts by 10cm. Resistance Q is

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2. The length of potentiometer wire is 1m and its resistance is 4Ω. Acurrent of 5mA is flowing in it. An unknown emf is balanced on 40 cm length of this wire. The unknown emf is x mv. What is the value of .x. ?

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PRACTICE SHEET (EXERCISE - VI LEVEL-I (MAIN) (Straight Objective Type Questions))

1. 60W-220V and 100W-220V bulbs are connected in series to 220V mains. The power consumption is more in the bulb of :

A. 60W

B. 100W

C. same for both the bulbs

D. none

Answer: A

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2. 60 W- 220 bulb and 100 W- 220 V bulb are connected in parallel to main supply . Which bulb will draw more current ?

A. 60W

B. 100W

C. 1000W

D. all are equally bright

Answer: C

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3. A bulb of 100W - 250V is connected to 250V mains. If another similar bulb is connected to it in series , the total power consumption is :

A. 100 W

B. 200 W

C. 50 W

D. 400 W

Answer: C

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4. The power of a heating coil is P. It is cut into two equal parts. The power of one of them across same mains is :

A. P

B. 2P

C. 4P

D. $P/2$

Answer: B

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5. In a house there are four bulbs each of 50W and 5 fans each of 60W. If they are used at the rate of 6 hours a day. The electrical energy consumed in a month of 30 days is

A. 90000 units

B. 90 units

C. 0.9 units

D. 900 units

Answer: B

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6. An electric bettle has two coils. When one coil is switched on it takes 15 minutes and the other takes 30 minutes to boil certain mass of water. The ratio of times taken by them, when connected in series and in parallel to boil the same mass of water is :

A. $1:3$

B. $5:2$

C. $7:3$

D. $9:2$

Answer: D

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7. The ratio of distance of two satellites from the centre of earth is 1 : 4. The ratio of their time periods of rotation will be :

A. $1:2$

B. $1:1$

C. $2:1$

D. $1:4$

Answer: C

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8. A 10 V storage battery of negligible internal resistance is connected across a 50Ω resistor. How much heat energy is produced in the resistor in 1 hour

A. 7200J

B. 6200J

C. 5200J

D. 4200J

Answer: A

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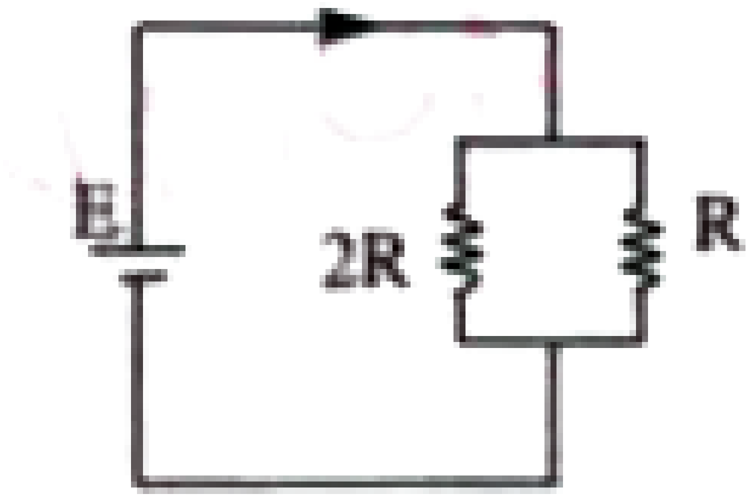
9. What is the ratio of heat generated in R and 2R



A. $2:1$

B. $1:2$

C. $4:1$

D. $1:4$

Answer: A

10. The frequency of oscillation of current in the indcutor is

A. $5^{0}C$

B. $10^{0}C$

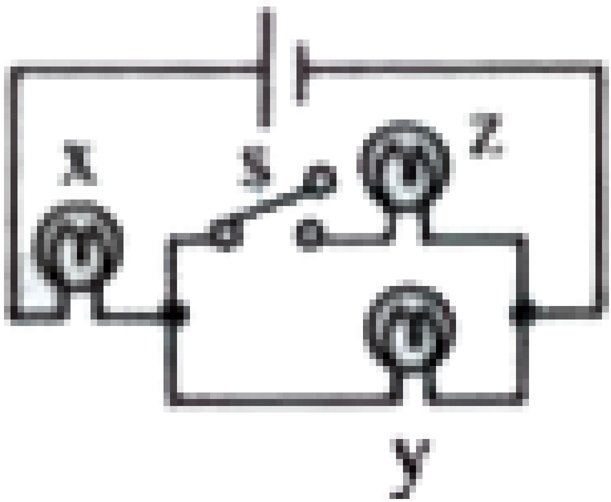
C. $20^{0}C$

D. $40^{0}C$

Answer: C

PRACTICE SHEET (EXERCISE - VI LEVEL-II (ADVANCED) (Straight Objective Type Questions))

1. 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

Answer: B

Watch Video Solution

2. What will be genotypic ratio in the F_2 generation of a monohybrid cross ?

A. $\frac{4}{3}\frac{q^2 R}{t_0}$

B. $\frac{2}{3}\frac{q^2 R}{t_0}$

C. $\frac{8}{3}\frac{q^2 R}{t_0}$

D. $\frac{q^2 R}{t_0}$

Answer: A

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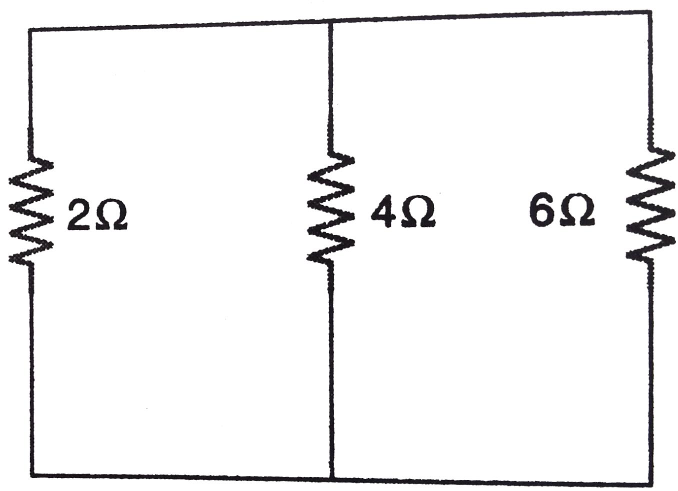
3. In which branch of the circuit shown in figure a $11V$ battery be inserted so that it dissipates minimum power. What will be the current through the 2Ω resistance for this potential of the battery?



A. 6Ω branch, 1A

B. 4Ω branch, 1A

C. 2Ω branch, 1A

D. 6Ω branch, 2A

Answer: A

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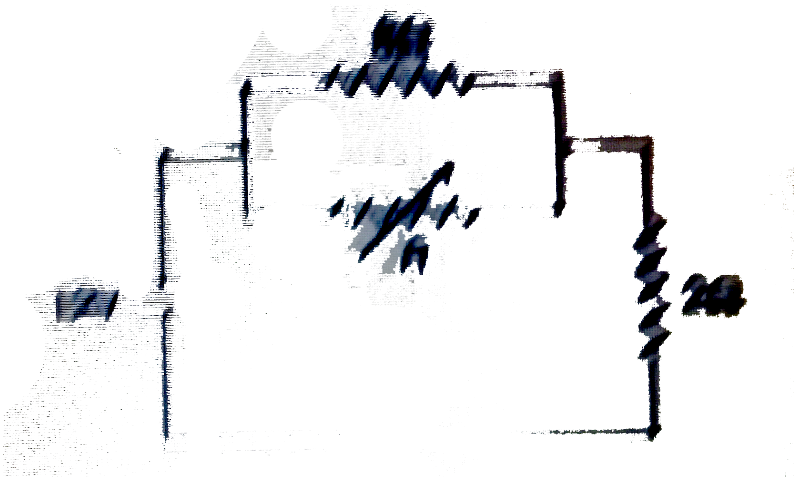
PRACTICE SHEET (EXERCISE - VI LEVEL-II (ADVANCED) (More than One correct Type Questions))

1. The value of the resistance R in figure is adjusted such that power dissipated in the 2Ω resistor is maximum. Under this condition



A. R = 0

B. $R = 8\Omega$

C. power dissipated in the 2Ω resistor is 72watts.

D. power dissipated in the 2Ω resistor is 8 watts.

Answer: A::C

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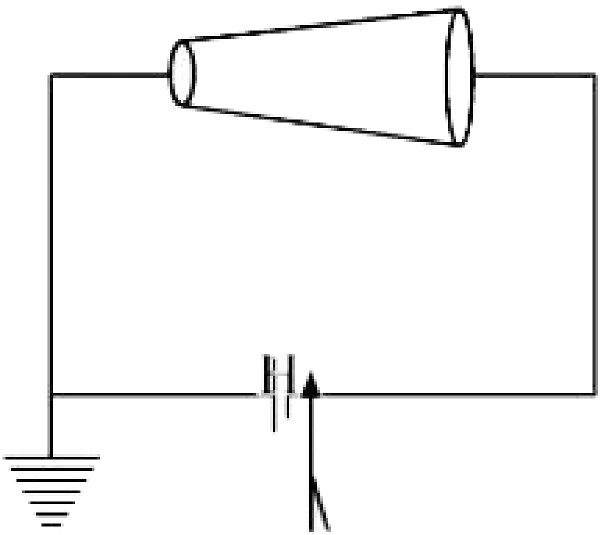
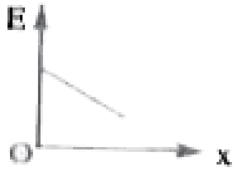
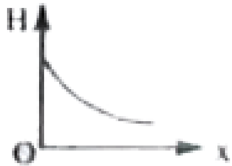
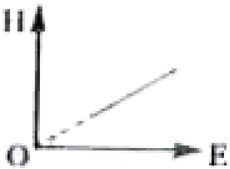
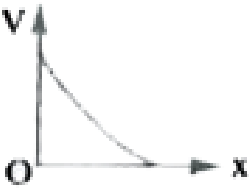
2. A conductor is made of an isotropic material and has shape of a truncated cone. A battery of constant emf is connected across it and its left end is earthed as shown. If at a certain section at a distance x form left end, electric field intensity and the rate of generation of heat per unit length are E and H respectively, which of the following graphs is (are) correct?



A. 

B. 

C. 

D. 

Answer: B::C

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3. Vocal cords occurs in

A. in parallel, the combination acts as a fuse of rating 20A

B. in parallel, the combination acts as a fuse of rating 5A

C. in series, the combination acts as a fuse of rating 10A.

D. in series, the combination acts as a fuse of rating 20A

Answer: A::C

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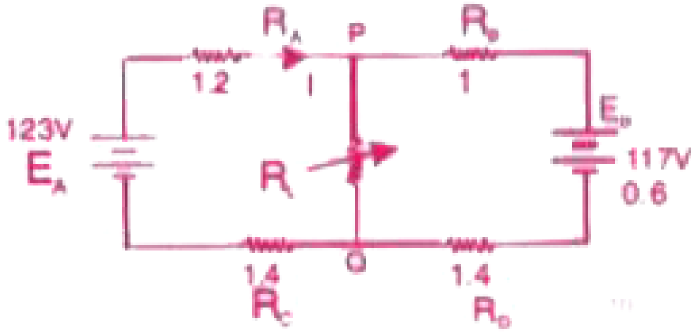
PRACTICE SHEET (EXERCISE - VI LEVEL-II (ADVANCED) (Linked Comprehension Type Questions))

1. Passage :

A battery E_A of 123 volts emf internal resistance 0.4Ω and a battery E_B of 117 V emf and internal resistance 0.6Ω supplies a current to load resistance R_L through four wires of resistors $R_A = 1.2\Omega$, $R_B = 1\Omega$, $R_C = 1.4\Omega$ and $R_D = 1.4\Omega$ as shown in figure.



The value of load resistance for maximum load power is

A. 1.5Ω

B. 3Ω

C. 4.5Ω

D. 6Ω

Answer: A

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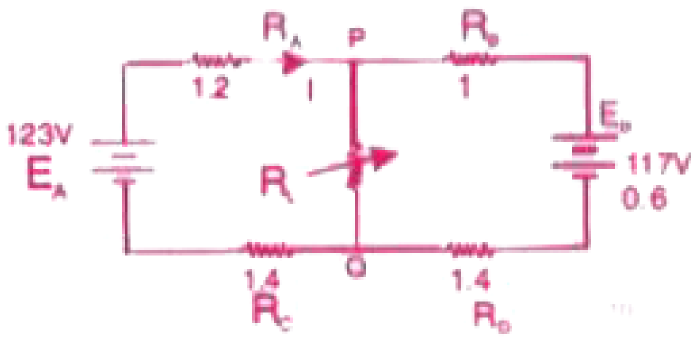
2. Passage :

A battery E_A of 123 volts emf internal resistance 0.4Ω and a battery E_B of 117 V emf and internal resistance 0.6Ω supplies a current to load resistance R_L through four wires of resistors $R_A = 1.2\Omega, R_B = 1\Omega, R_C = 1.4\Omega$ and $R_D = 1.4\Omega$ as shown in figure.



The value of load resistance for maximum load power is

A. 800 W

B. 1600 W

C. 2400 W

D. 3200 W

Answer: C

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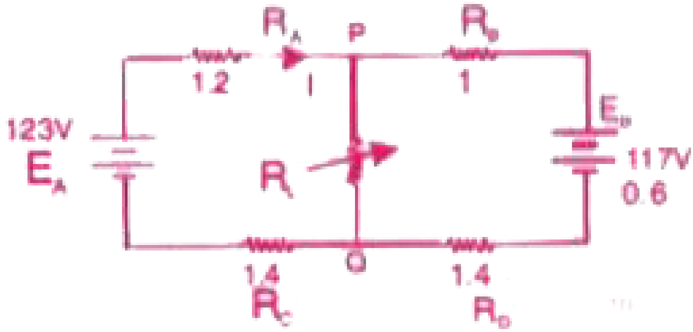
3. Passage :

A battery E_A of 123 volts emf internal resistance 0.4Ω and a battery E_B of 117 V emf and internal resistance 0.6Ω supplies a current to load resistance R_L through four wires of resistors $R_A = 1.2\Omega$, $R_B = 1\Omega$, $R_C = 1.4\Omega$ and $R_D = 1.4\Omega$ as shown in figure.



The value of load resistance for maximum load power is

A. $25\ \%$

B. $50\ \%$

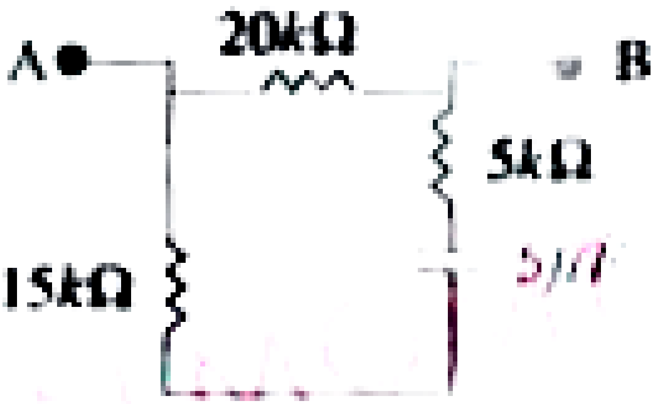
C. $75\ \%$

D. $100\ \%$

Answer: B

Watch Video Solution

1. The value of the resistance as measured across terminals A and B in fig would be at steady state



A. $5k\Omega$

B. $10k\Omega$

C. $15k\Omega$

D. $20k\Omega$

Answer: D

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2. How many time constants will elapse before the current in a charging RC circuit drops to half of its initial value?Answer the same question for a discharging RC circuit.

A. 1.9

B. 1.23

C. 0.69

D. 0.79

Answer: D

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3. How many time constants will elapse before the energy stored in the capacitor reaches half of its equilibrium value in a charging RC circuit ?

A. 1.23

B. 0.69

C. 2.46

D. 3.69

Answer: A

Watch Video Solution

4. how many time constants will elapse before the power delovered by the battery drops to half of its maximum value in an RC circuit ?

A. 1.23

B. 0.69

C. 2.46

D. 3.69

Answer: B

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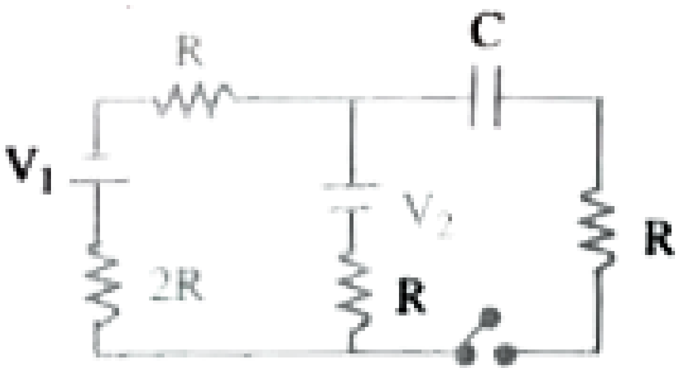
5. In the transient circuit shown, the time constant of the circuit is :



A. $\frac{5}{3}RC$

B. $\frac{5}{2}RC$

C. $\frac{7}{4}RC$

D. $\frac{7}{3}RC$

Answer: C

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PRACTICE SHEET (EXERCISE - VII LEVEL-II (ADVANCED) (Straight Objective Type Questions))

1. An LR circuit with a battery connected at t =0. Which of the following quantities will be zero just after the connection?

A. $51\mu V / m$

B. $17\mu V / m$

C. $1.7 \times 10^4 V / m$

D. $34\mu V / m$

Answer: C

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2. At the trophic level of consumers, the rate at which food energy is assimilarted, is called ?

A. $E^2 / 4R$, 2CR ln 2

B. $E^2 R$, 2CR ln 2

C. $\frac{E^2}{4R}$, CR ln 2

D. $\frac{E^2}{2R}$, Cr ln 2

Answer: C

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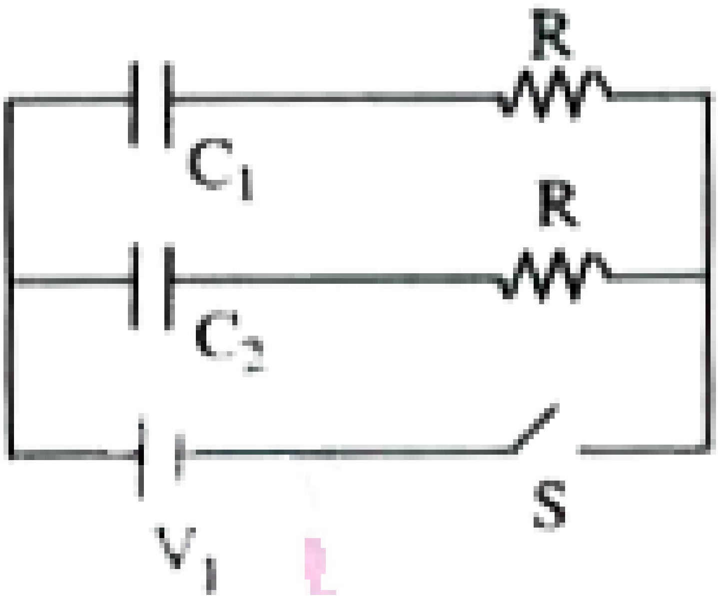
3. In the circuit shown in figure $C_1 = 2C_2$, Switch S is closed at time t = 0, Let i_1 and i_2 be the currents flowing through C_1 and C_2 at any time t, then the ratio i_1 / i_2



A. is constant

B. increases with increase in time t

C. decreases with increase in time t

D. first increases then decreases

Answer: B

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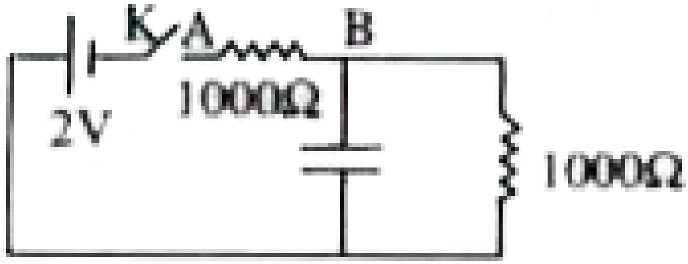
4. In the circuit shown, when the key k is pressed at time t = 0, which of the following statements about current I in the resistor AB is true



A. I = 2mA at all t

B. I oscillates between 1 mA and 2mA

C. I = 1 mA at all t

D. At t = 0, I = 2mA and with time it goes to 1 mA

Answer: D

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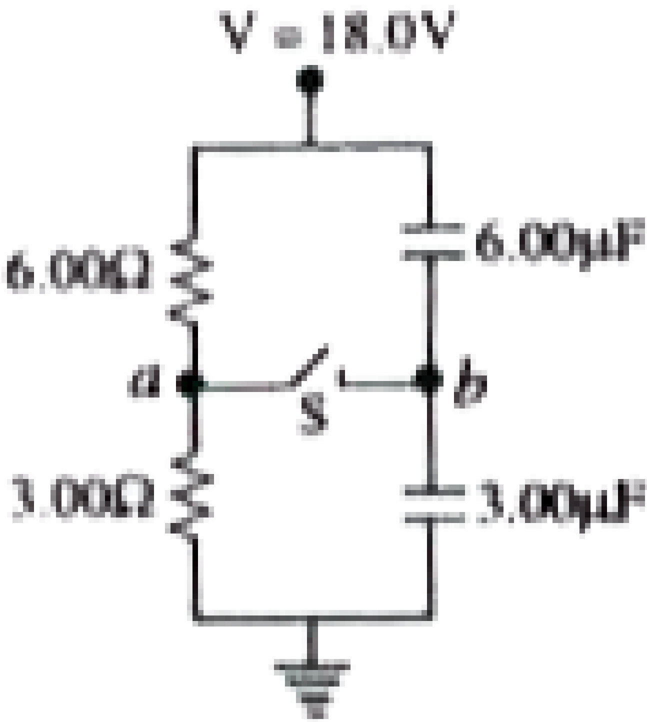
PRACTICE SHEET (EXERCISE - VII LEVEL-II (ADVANCED) (More than One correct answer Type Questions))

1. Study the following circuit diagram and mark the correct options.



A. The potential of point a with respect to point b in figure when switch S is open is -6V.

B. The points a and b are at the same potential, when S is opened.

C. The charge flown through the switch S when it is closed is $54\mu C$.

D. The final potential of b with respect to ground when switch S is closed is 8V.

Answer: A::C

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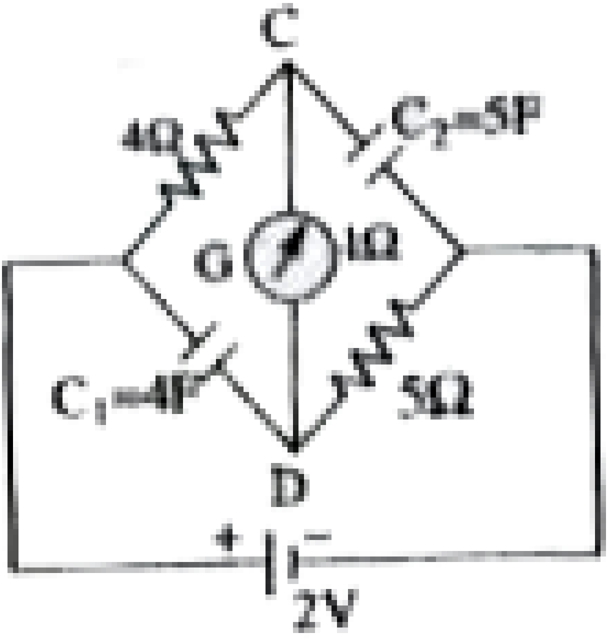
2. In the circuit shown in Fig., the cell is ideal with e.m.f = 2V. The resistance of the coil of the galvanometer G is 1Ω. Then



A. initially no current flows in G

B. in steady state 0.2 A current flows in G

C. potential difference across C_1 is 1V

D. potential difference across C_2 is 1.2 V

Answer: B::C::D

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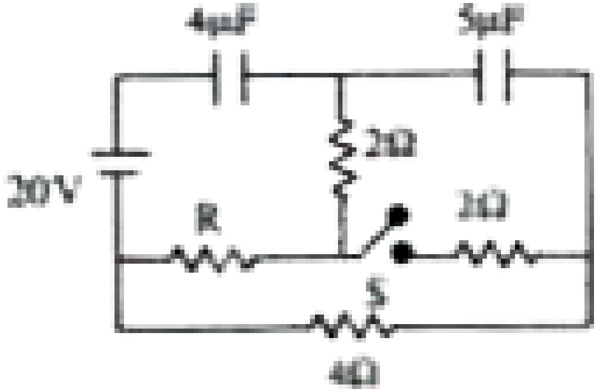
PRACTICE SHEET (EXERCISE - VII LEVEL-II (ADVANCED) (Integer Type Questions))

1. Find heat produced in the capacitors on closing the switch S after long time (in joules).



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ADDITIONAL PRACTICE EXERCISE (LEVEL -I(MAIN) (Straight Objective Type Questions))

1. The current through a wire depends on time as

$I = i_0 + \alpha t,$

where $i_0 = 10A$ and $\alpha = 4As^{-1}$.Find the charge crossed through a section of the wire in 10 second

A. 100 C

B. 200 C

C. 300 C

D. 400 C

Answer: C

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2. The space between the plates of a parallel plate capacitor is completely filled with a material of resistivity $2 \times 10^{11} \Omega m$ and dielectric constant 6. Capacity of the capacitor with the given dielectric medium between the plates is $20 \mu F$. Find the leakage current if a potential difference $2500V$ is applied across the capacitor.

A. $4.7\mu A$

B. $1.2\mu A$

C. $8.3\mu A$

D. $10.5\mu A$

Answer: A

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3. A cylinderical tube of length L has inner radius a and outer radius b. What is the resistance of the tube between its inner and outer surface ? Given that the resistivity of its material is ρ.

A. $\rho(2\pi L)\ln\left(\frac{b}{a}\right)$

B. $\frac{\rho}{4\pi L}\ln\left(\frac{b}{a}\right)$

C. $\frac{\rho}{2\pi L}\ln\left(\frac{2b}{a}\right)$

D. $\frac{\rho}{\pi L}\ln\left(\frac{b}{a}\right)$

Answer: B

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4. The conductance of a solution of an electrolyte is equal to that of its specific conductance The cell constant of the conductivity cell is equal to

A. $\frac{\rho_0 l}{A}\left[1+\frac{\alpha l}{2}\right]$

B. $\frac{\rho_0 l}{A}[1+\alpha l]$

C. $\frac{\rho_0 l}{A}\left[1+\frac{\alpha l^2}{2}\right]$

D. $\frac{\rho_0 l}{A}[1+2\alpha l]$

Answer: A

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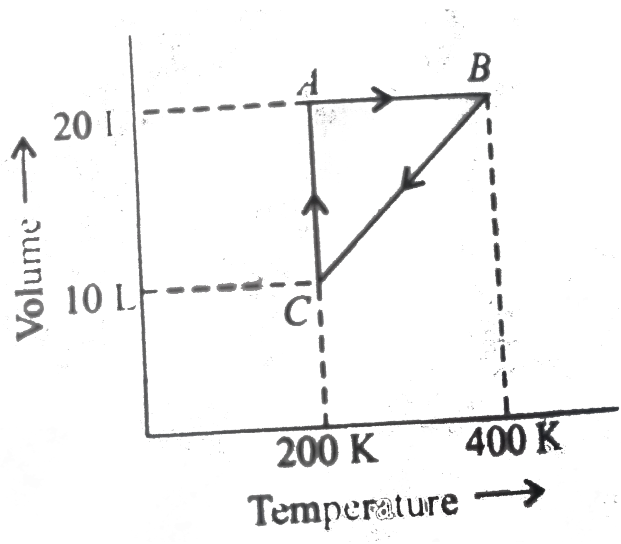
5.



The pressures at A and B in the atmosphere are, respectively,

A. $\dfrac{\sigma_1 V_1 + \sigma_2 V_2}{(\sigma_1/L_1) + (\sigma_1/L_2)}$

B. $\dfrac{\frac{\sigma_1 V_1}{L_1} + \frac{\sigma_2 V_2}{L_2}}{(\sigma_1/L_1) + (\sigma_1/L_2)}$

C. $\dfrac{(\sigma_1/V_1) + (\sigma_2/V_2)}{\sigma_1 V_1 + \sigma_2 V_2}$

D. $\dfrac{\sigma_1 V_1 - \sigma_2 V_2}{(\sigma_1/L_1) - (\sigma_1/L_2)}$

Answer: B

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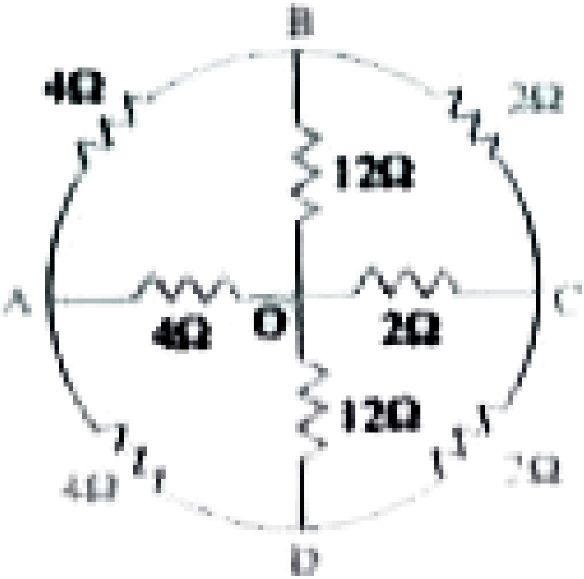
6. The resistance between OA is given by



A. 1Ω

B. 2Ω

C. 3Ω

D. 4Ω

Answer: B

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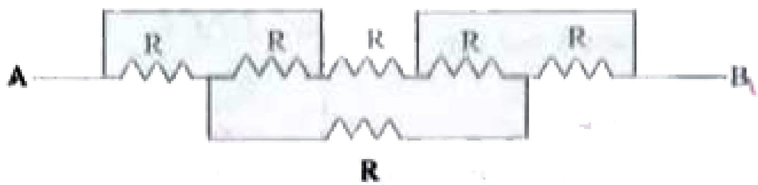
7. Find the equivalent resistance between A and B in the following circuit.



A. $\frac{5R}{3}$

B. $\frac{5R}{2}$

C. $\frac{2R}{3}$

D. $\frac{5R}{6}$

Answer: C

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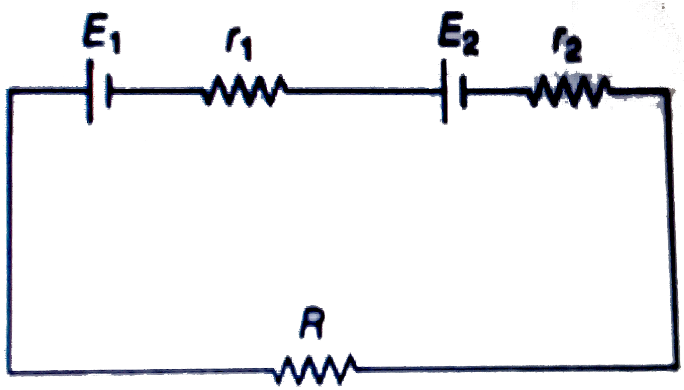
8. Under what conditions current passing through the resistance R can be increased by short circuiting the battery of emf E_2. The internal resistances of the two batteries are r_1 and r_2 respectively



A. $E_2 r_1 > E_1(R + r_2)$

B. $E_1 r_2 > E_2(R + r_1)$

C. $E_2 r_2 > E_1(R + r_2)$

D. $E_1 r_1 > E_2(R + r_1)$

Answer: B

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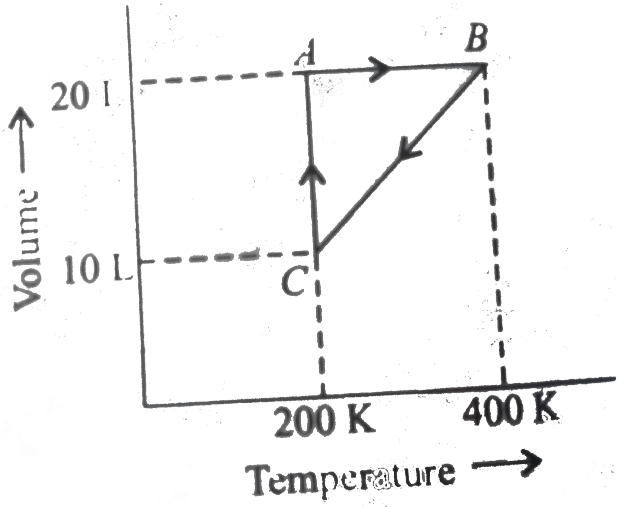
9.



The pressures at A and B in the atmosphere are, respectively,

A. 1

B. 6

C. 4

D. 8

Answer: A

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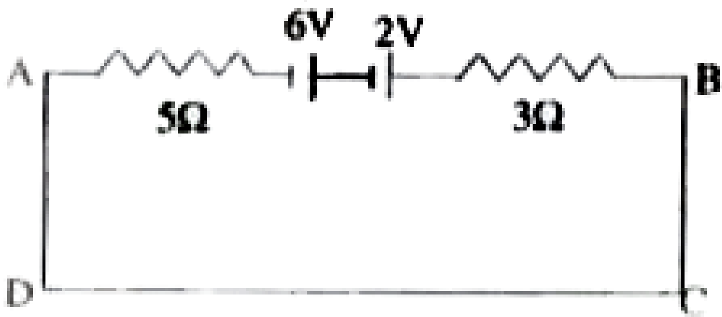
10. The internal resistanes of cells in the circuit shown in the figure are negligible. The current in the circuit is



A. 0.5A flowing from A to D

B. 0.5A flowing from B to C

C. 1.0A flowing from A to B

D. 1.0A flowing from B to A

Answer: B

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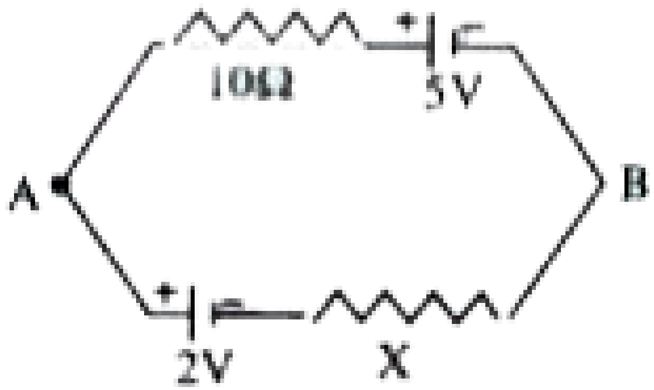
11. In the given circuit, if potential difference between points A and B is 4V. Then, resistance X is



A. 5Ω

B. 10Ω

C. 15Ω

D. 20Ω

Answer: D

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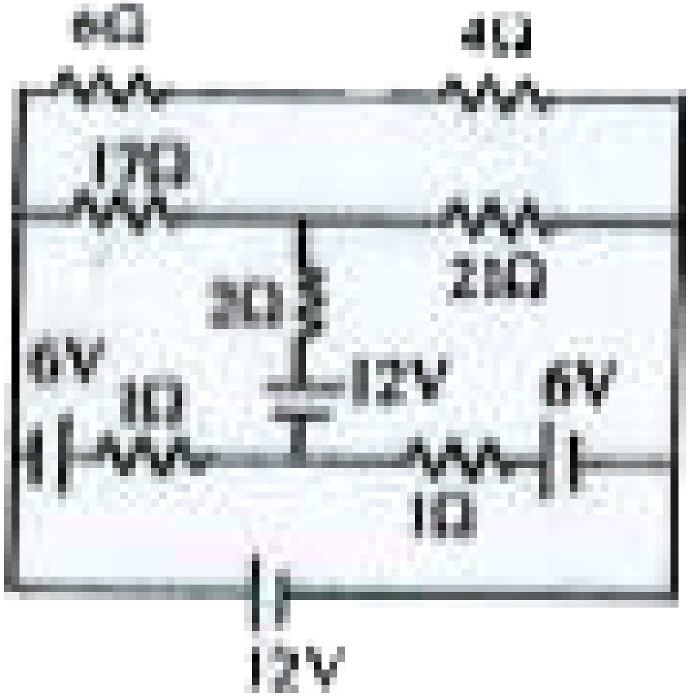
12. Choose the correct statement(s) from the following option for given diagram



A. potential drop across 6Ω is 3.2 V

B. potential drop across 4Ω is 4.8V

C. potential drop across 6Ω is 4.8V

D. potential drop across 4Ω is zero

Answer: B

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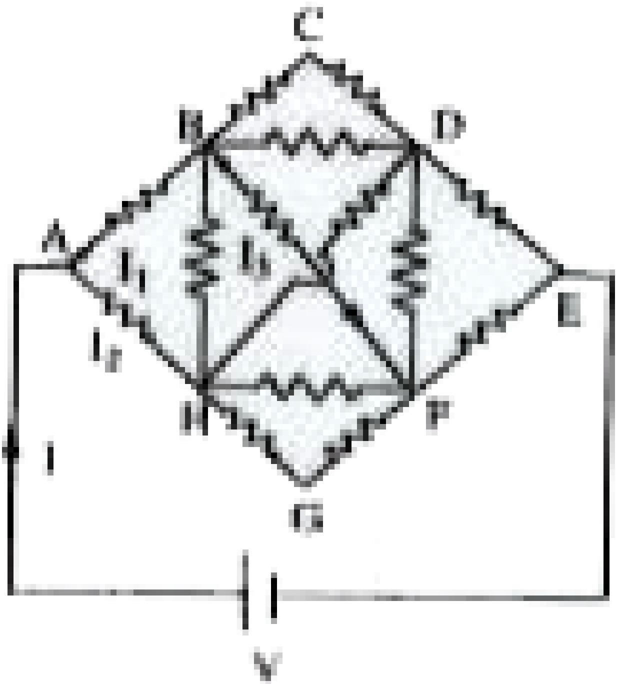
13. Fourteen identical resistors, each of resistance r each connected as shown in figure. Pick the incorrect alternative(s)



A. Relation between I and I_3 is $I = 5I_3$

B. Effective resistance between A and E is 1.6r

C. The value of I_3 in terms of I_1 is $\frac{2I_1}{5}$

D. Effective resistance between A and E is 1.2r

Answer: B

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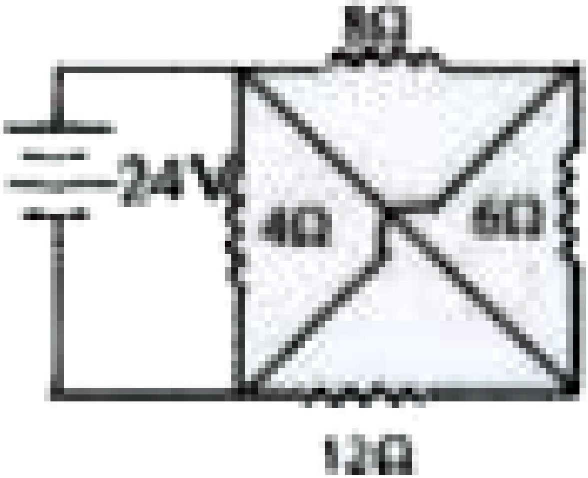
14. Calculate battery current and equivalent resistance of the network shown in figure.



A. $20V, 5\Omega$

B. $5A, \frac{8}{5}\Omega$

C. $15A, \frac{8}{5}\Omega$

D. $9A, \frac{8}{3}\Omega$

Answer: C

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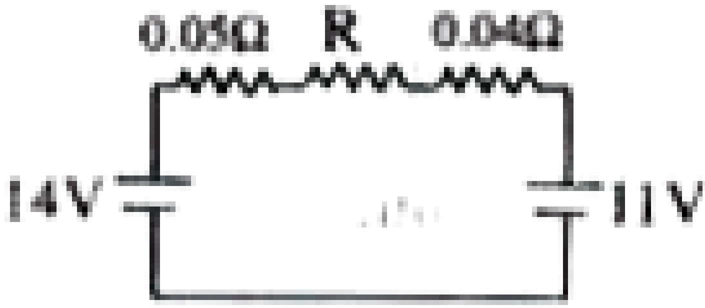
15. For the circuit shown in figure the value of R so that 25W of electrical energy is delivered to a combination of 11V battery and 0.04Ω resistor is



A. 1.11Ω

B. 1.24Ω

C. 1.18Ω

D. None of these

Answer: B

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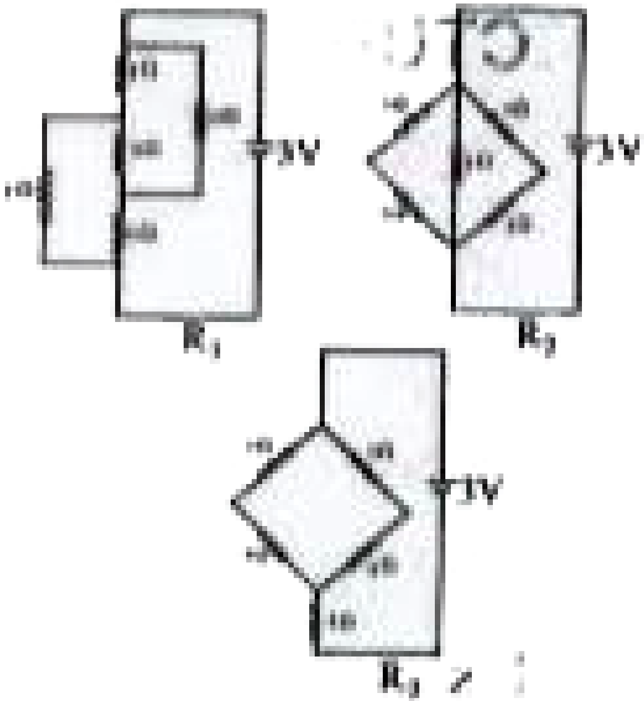
16. Fig shows three resistor configuration R_1, R_2 and R_3 connected to 3V battery. If the power dissipated by the configuration R_1, R_2 and R_3 is P_1, P_2 and P_3 respectively, then



A. $P_1 > P_2 > P_3$

B. $P_1 > P_3 > P_2$

C. $P_2 > P_1 > P_3$

D. $P_3 > P_2 > P_1$

Answer: C

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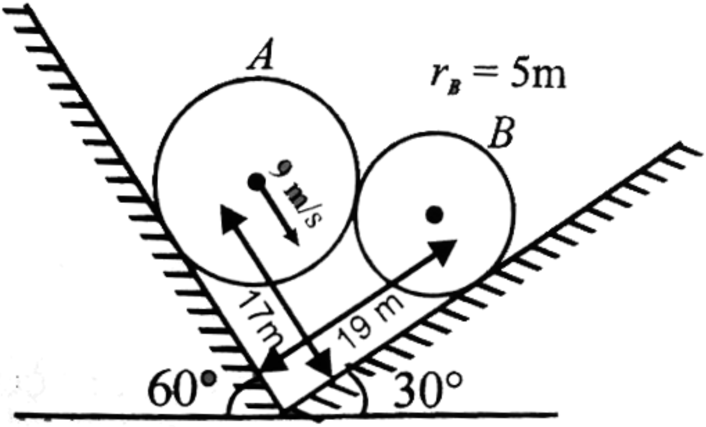
17.



System is shown in the figure. Velocity of sphere A is 9 $\frac{m}{s}$. Find the speed of sphere B.

A. 7 mA

B. 8 mA

C. 10 mA

D. 11 mA

Answer: D

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18. Two motor boats A and B move from same point along a circle of radius 10 m in still water. The boats are so designed that they can move only with constant speeds. The boats A and B take 16 and 8 sec respectively to complete one circle in stationary water. Now water starts flowing at $t = 0$ with a speed $4\frac{m}{s}$ in a fixed direction. Find the distance between the boats after $t = 8$ sec.

A. $\frac{1}{6}m$

B. $\frac{1}{3}m$

C. 25 cm

D. 50 cm

Answer: C

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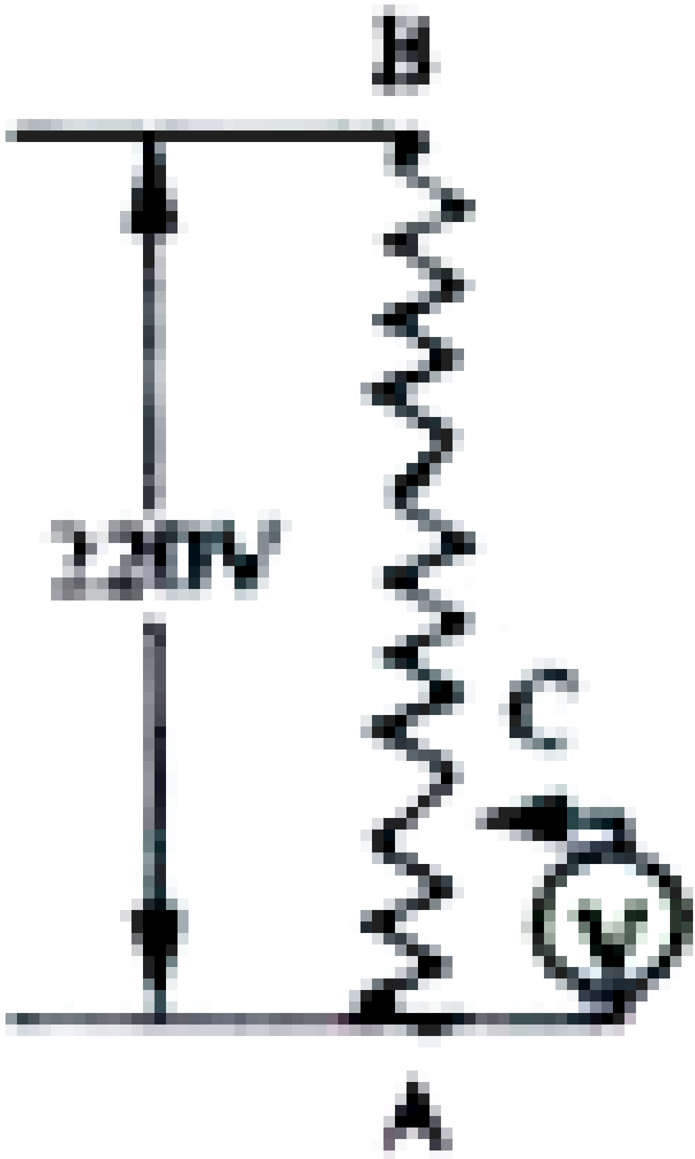
19. A potential difference of 220 V is maintained across a 12000 ohm rheostat AB. The voltmeter V has a resistance of 6000 ohm and point C is at one fourth of the distance from A to B. What is the reading in the voltmeter ?



A. 40 V

B. 80 V

C. 20 V

D. 100 V

Answer: A

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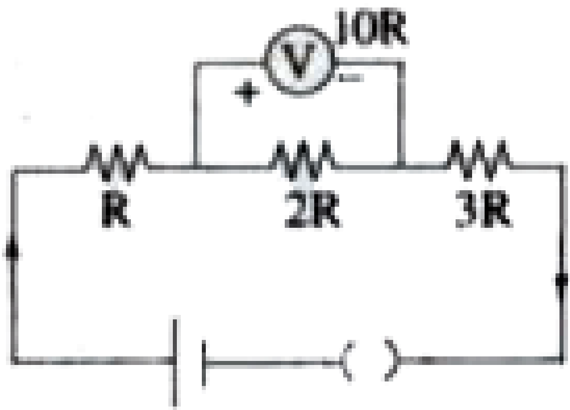
20. A battery of emf E is connected in series with three resistances R, 2R and 3R. The voltage across 2R is measured with a voltmeter whose resistance is 10 R.

What is the percentage error in the reading?



A. 11.76% more than the true value

B. 6.3% more than the true value

C. 11.76% less than the true value

D. 6.3% less than the true value

Answer: C

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ADDITIONAL PRACTICE EXERCISE (LEVEL -II LECTURE SHEET (ADVANCED) (Straight Objective Type Questions))

1. A n-type silicon sample of width $4 \times 10^{-3} m$, thickness $25 \times 10^{-5} m$ and length $6 \times 10^{-2} m$ carries a current of 4.8 mA when the voltage is applied across the length of the sample. If the free electron density is $10^{22} m^{-3}$, then find how much time does it take for the electrons to travel the full length of the sample? Given that charge on an electron $e = 1.6 \times 10^{-19} C$

A. 0.02 s

B. 0.01 s

C. 0.04 s

D. 0.06 s

Answer: A

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2. A potential difference of 30V is applied between the ends of a conductor of length 100 m and resistance 0.5Ω . The conductor has a uniform cross-section. Find the total linear momentum of free electrons.

A. $10^{-9} kg. m/s$

B. $6.8 \times 10^{-8} kg. m/s$

C. $3.4 \times 10^{-9} kg. m/s$

D. $3.4 \times 10^{-8} kg. m/s$

Answer: D

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3. A long round conductor of cross-sectional area S is made of material whose resistivity depends only on a distance r from the axis of the conductor as $\rho = \alpha / r^2$, where α is a constant. Find the total resistance per unit length of the rod when potential difference is applied across its length.

A. $\frac{\pi\alpha}{S^2}$

B. $\frac{2\pi\alpha}{S^2}$

C. $\frac{\pi\alpha}{2S^2}$

D. $\frac{\alpha}{S^2}$

Answer: B

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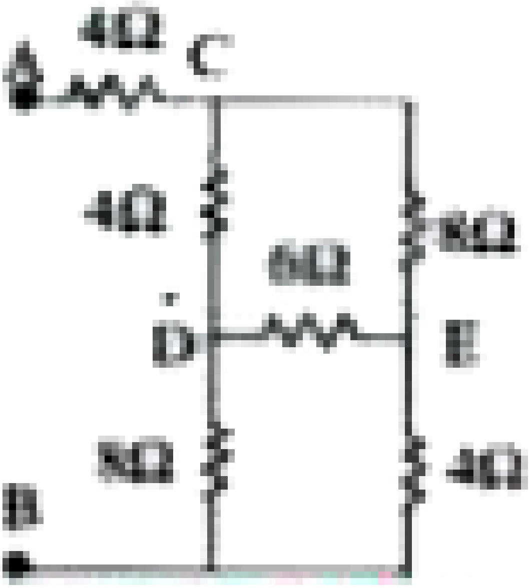
4. Find the input resistance of the circuit between the points A and B of fig. shown



A. $\frac{87}{9}\Omega$

B. $\frac{87}{3}\Omega$

C. $\frac{24}{9}\Omega$

D. $\frac{12}{9}\Omega$

Answer: A

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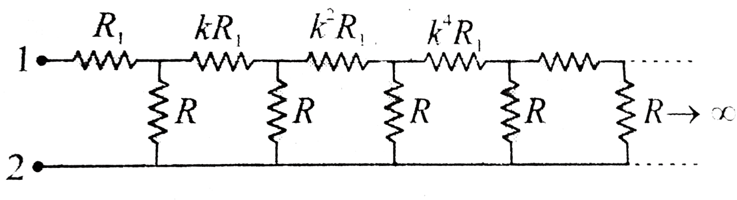
5. The circuit diagram shwon in the fig consist of a large number of elementws (each element has two resistors R_1 and R_2. The resistance of the resistors in each subsequent element differs by a factor of $k = \frac{1}{2}$ from the resistance of the resistors in previous elements find the equivalent resistance between A and B shown in



A. $\dfrac{R_1 - R_2}{2}$

B. $\dfrac{(R_1 - R_2) + \sqrt{6R_1R_2}}{2}$

C. $\dfrac{(R_1 - R_2) + \sqrt{R_1^2 + R_2^2 + 6R_1R_2}}{2}$

D. None of these

Answer: A

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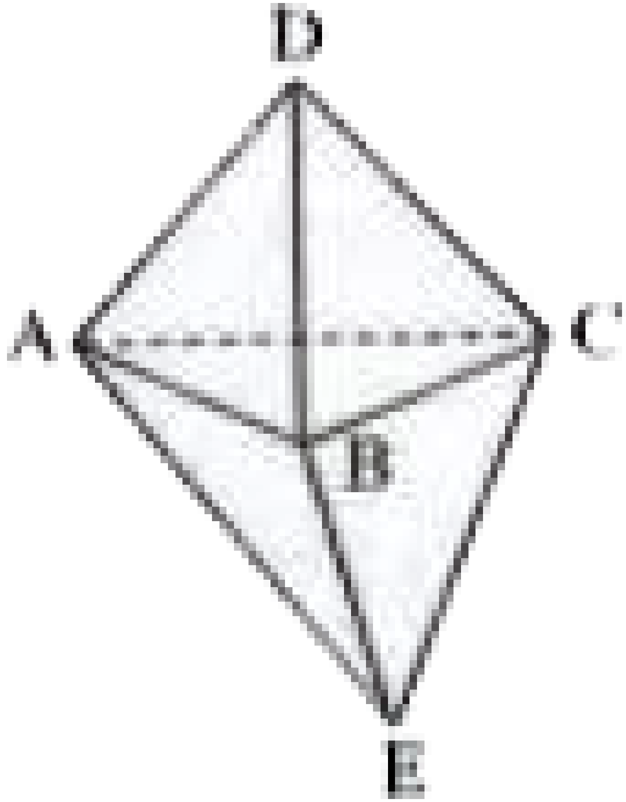
6. Find the equivalent resistance of the triangular bipyramid between the points

A) A and C B) D and E

Assume the resistance of each brach to be R.



A. $\frac{4R}{5}, \frac{2R}{3}$

B. $\frac{2R}{5}, \frac{4R}{3}$

C. $\frac{4R}{5}, \frac{4R}{3}$

D. $\frac{2R}{5}, \frac{2R}{3}$

Answer: D

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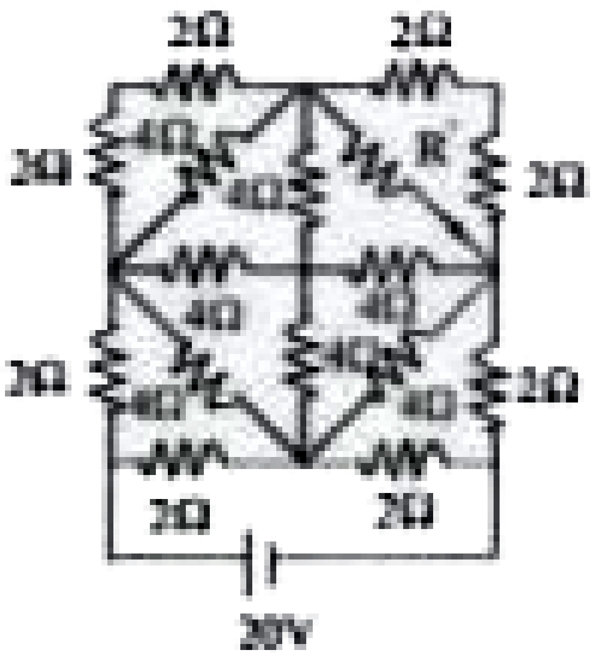
7. In the circuit shown, all the side resistances are of value 2Ω and all inner resistances are of value 4Ω. Find the current via branch $R. = 4\Omega$.



A. 5.2A

B. 6.7A

C. 0.833A

D. 10.5A

Answer: C

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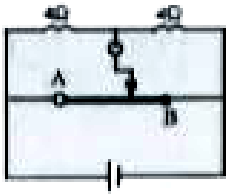
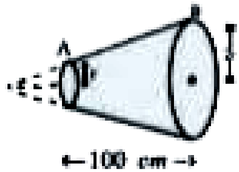
8. The wire AB of a meter bridge changes linearly form radius r to 2r from left end to right end. Where should the free end of the galvanometer be connected on AB so that the deflection in the galvanometer is zero?





A. 33.33 cm from A

B. 66.66 cm from A

C. 50 cm from A

D. 20 cm from B

Answer: A

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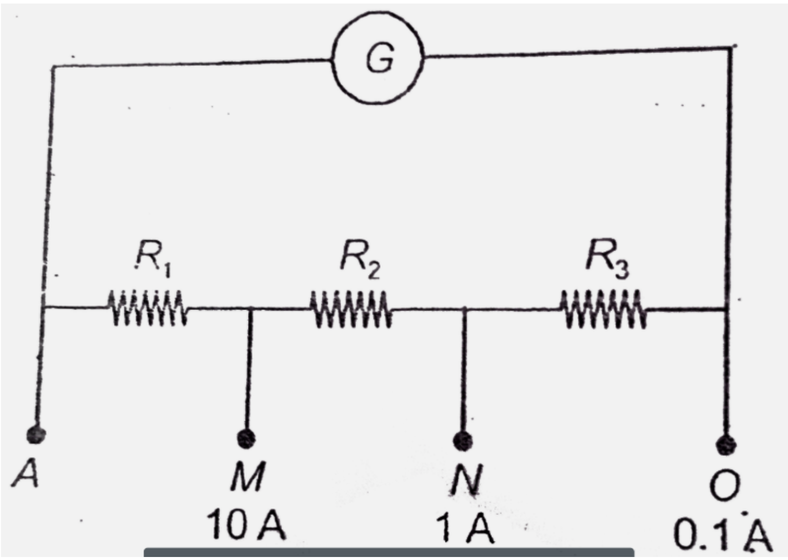
9. The galvanometer shown in figure has resistance 50 Ω and current required for full scale deflection is 1mA. Find the resistance R_1, R_2 and required to convert to convert it into ammeter having ranges as indicated.



A. $\frac{1}{22}\Omega, \frac{15}{33}\Omega, \frac{1}{100}\Omega$

B. $\frac{1}{22}\Omega, \frac{1}{33}\Omega, \frac{1}{44}\Omega$

C. $\frac{1}{22}\Omega, \frac{1}{33}\Omega, \frac{1}{44}\Omega$

D. $\frac{1}{198}\Omega, \frac{1}{22}\Omega, \frac{15}{33}\Omega$

Answer: D

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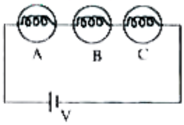
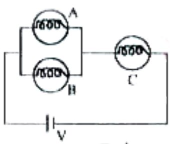
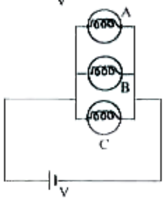
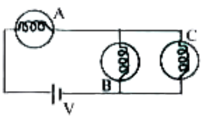
ADDITIONAL PRACTICE EXERCISE (LEVEL -II LECTURE SHEET (ADVANCED) (Matrix Matching Type Questions))

1. Three bulbs A, B and C having rated power P_A, P_B and P_C, respectively. Each bulb is designed to operate at rated voltage of V volts. It is given that $P_A > P_B > P_C$. In columnI, different configurtaions of bubls are given while in ColumnII, intensities are mentioned. Match entires of ColumnI with entries of

ColumnII, neglecting the change of resistances of bulbs due to temperature change.

COLUMN - I	COLUMN - II
A) 	p) A glows with minimum intensity
B) 	q) C is glowing with maximum intensity
C) 	r) B is glowing with minimum intensity
D) 	s) A is glowing with maximum intensity

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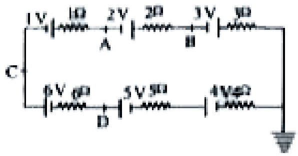
2. Six batteries of increasing emf and increasing internal resistance are as shown in figure. Match the following:



COLUMN - I	COLUMN - II
A) Potential of point A	p) Zero
B) Potential of point B	q) 2V
C) Potential of point C	r) 6 V
D) Potential of point D	s) 6V
	t) None

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ADDITIONAL PRACTICE EXERCISE (LEVEL -II LECTURE SHEET (ADVANCED) (Integer Type Questions))

1. Current density in a cylindrical wire of radius R is given as $J = \begin{cases} J_0\left(\frac{x}{R} - 1\right) & \text{for } 0 \le x < \frac{R}{2} \\ J_0\frac{x}{R} & \text{for } \frac{R}{2} \le x \le R \end{cases}$.

If the current flowing in the wire is $\frac{k}{12}\pi J_0 R^2$, find the value of k.

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2. A copper of rod (resistivity $2.2 \times 10^{-8} \Omega - m$) and an iron (resistivity $1.1 \times 10^{-8} \Omega - m$) rod of same length 70 cm each and same diameter 1.4 mm each are joined in series, then the combined resistance is

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3. Consider a copper cylinder of volume x, resistivity f, resistance across its length is r. If diameter of cylindrical conductor is $\left(\frac{16fx}{\pi^2 r}\right)^{1/k}$, then find the value of k.

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4. One kilowatt electric heater is to be used with 220V DC supply. It converts $\frac{N \times 10}{3} g$ of water at $100^0 C$ into steam at $100^0 C$ in one minute. find the value N.

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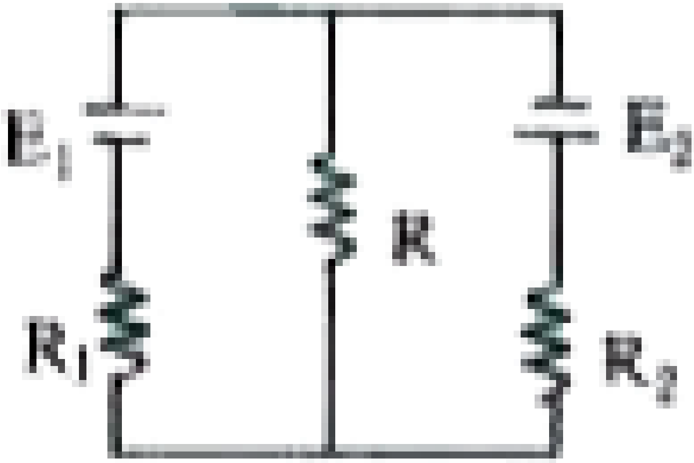
5. In the circuit shown in figure $R_1 = R_2 = 10\Omega, E_1 = 20V, E_2 = 40V$. For what value of R, the thermal power developed in it will be maximum (in Ω)?



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6. A capacitor $C = 100\mu F$ is connected to three resistance each of resistance $1k\Omega$ and a battery of emd $9V$ switch S has been closed for long time so as to the capacitor. When switch S is opened capacitor discharges with time constant

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7. A galvanometer having a resistance of 50Ω, gives a full scale deflection for a current of 0.05A. The length in metre of a resistance wire of area of cross - section $2.97 \times 10^{-2} cm^2$ that can be used to convert the galvanometer into an ammeter which can read a maximum of 5A current is (Specific resistance wire $= 5 \times 10^{-7} \Omega - m$)

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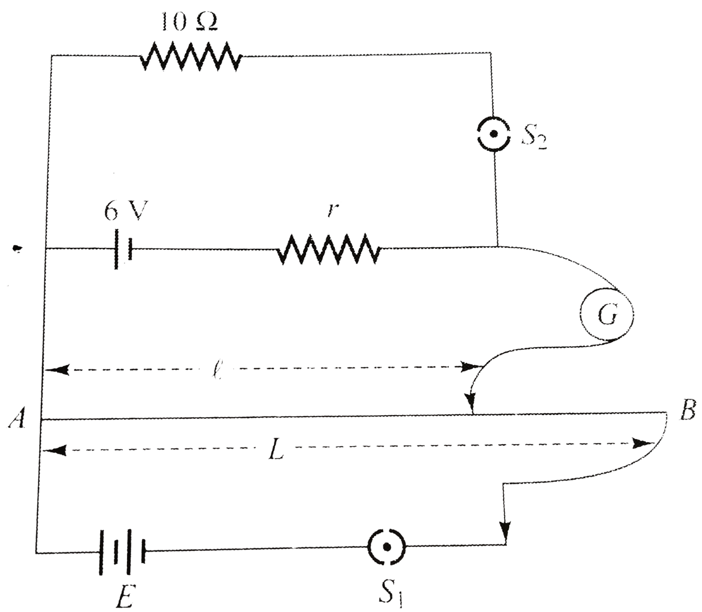
8. In the arrangement shows in fig. , when the switch S_2 is open, the galvanometer shows no deflection for $l = L/2$. When the switch S_2 is closed, the galvanometer shows no deflection for $l = 5/12L$. The internal resistance (r) of 6 V cell and the emf E of the other battery are, respectively



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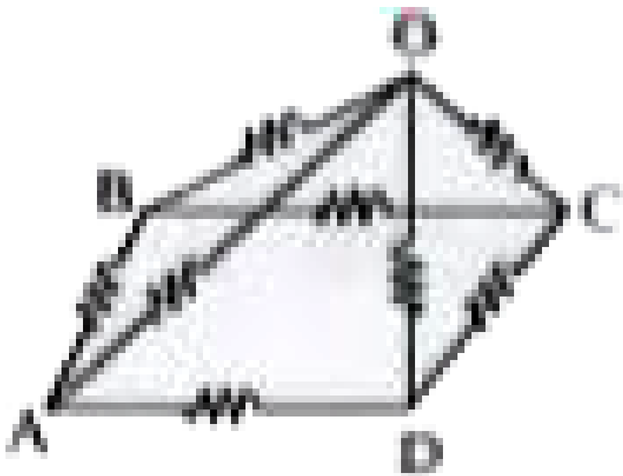
ADDITIONAL PRACTICE EXERCISE (LEVEL -II PRACTICE SHEET (ADVANCED) (Straight Objective Type Questions))

1. Eight identical resistances reach are connected along edges of a pyramid having square base ABCD as shown. Calculate equivalent resistance between A and D.



A. $\frac{5r}{6}$

B. $\frac{7r}{12}$

C. $\frac{4r}{3}$

D. $\frac{8r}{15}$

Answer: D

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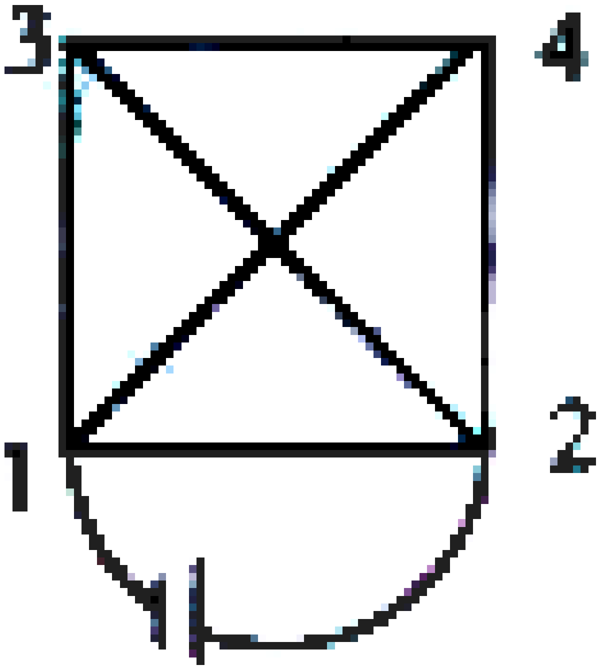
2. The circuit in figure is made of a homogeneous wire of uniform cross-section. 1234 is a square. Find the ratio Q_{12}/Q_{34} of the amounts of heat liberated per unit time in conductor 1-2 and 3-4



A. $3-\sqrt{2}$

B. $2+\sqrt{2}$

C. $11+6\sqrt{2}$

D. $\sqrt{2}+3$

Answer: C

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3. A block of metal is heated directly by dissipating power in the internal resistance of block. Because of temperature rise, the resistance increases exponentially with time and is given by $R(t) = 0.5e^{2t}$, where t is in seconds. The block is connected across a 110 V source and dissipates 7644 J heat over a certain period of time. Calculate this period of time.

A. 0.5 s

B. 1s

C. 1.5 s

D. 2s

Answer: A

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4. A conductor has a temperature independent resistance R and a total heat capacity C. At the moment $t = 0$ it is connected to a DC voltage V. Find the times dependence of the conductors temperature t assuming the thermal power dissipated into surrounding space to vary as $q = k(T - T_0)$ where k is a constant T_0 is the surrounding temperature (equal to conductor's temperature at the initial moment).

A. $T = \frac{V^2}{kR} e^{\frac{-kt}{C}}$

B. $T = T_0 + \frac{V^2}{KR}\left[1 - e^{\frac{-Kt}{C}}\right]$

C. $T = T_0 + \frac{V^2}{kR} e^{\frac{-kt}{C}}$

D. $T = \left(T_0 + \frac{V^2}{kR}\right) e^{\frac{-kt}{C}}$

Answer: B

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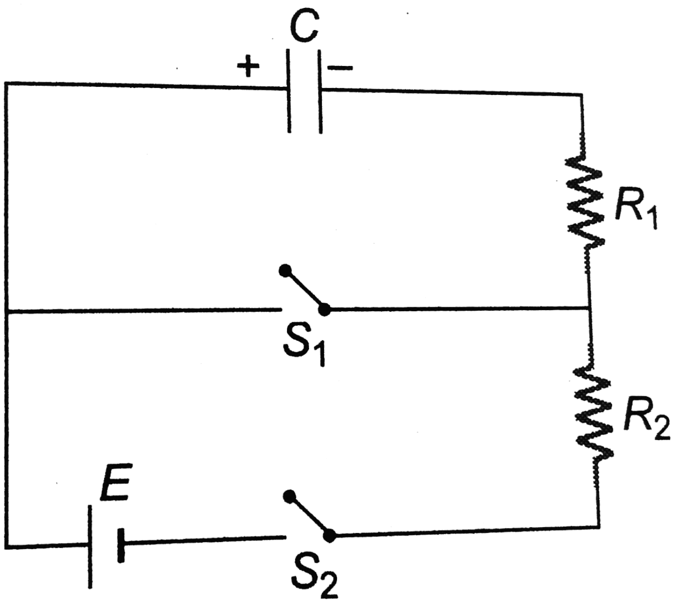
5. The capacitor shown in figure has been charged to a potential difference of V volt, so that it carries a charge CV with both the switches S_1 and S_2 remaining open. Switch S_1 is closed at $t = 0$. At $t = R_1 C$ switch S_1 is opened and S_2 is closed. Find the charge on the capacitor at $t = 2R - 1C + R_2C$.



A. $CD(e-1)+\frac{CV}{e}$

B. $CE\left(1-e^2\right)+\frac{CV}{e}$

C. $CE\left(1-\frac{1}{e}\right)+\frac{CV}{e^2}$

D. $CE\left(1-\frac{1}{e}\right)-\frac{CV}{e^2}$

Answer: C

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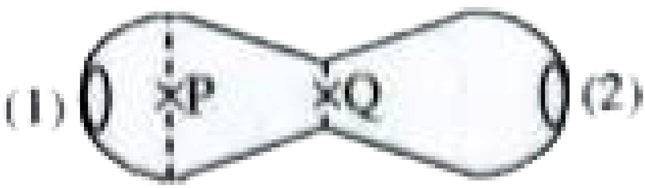
ADDITIONAL PRACTICE EXERCISE (LEVEL -II PRACTICE SHEET (ADVANCED) (More than One correct answer Type Questions))

1. A metallic conductor of irregular cross-section is as shown in the figure. A constant potential difference is applied across the ends (1) and (2). Then :



A. the current at the cross-section P equals the current at the cross-section Q

B. the electric field intensity at P is less than that at Q.

C. the rate of heat generated per unit time per unit length at Q is greater than that at P

D. the number of electrons crossing per unit area of cross-section at P is less than that at Q.

Answer: A::B::C::D

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2. The resistivity of cylindrical conductor carrying steady current along its length varies linearly with the distance from the current carrying end as given by $\rho = \rho_0\left(1 + \frac{x}{l}\right)$ where l is the length of the conductor and x is the distance from the current entry and. ρ_o is a positive constant.

A. Electric field varies linearly with x

B. Electric potential difference across the length varies linearly with x

C. Volume charge density in the conductor is zero

D. volume charge density in the conductor is non zero.

Answer: A::B

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3. A wire of 5.8 m long, 2 mm diameter carries 750 mA current when 22 mV potential difference is applied at its ends. If drift speed of electrons is found 1.7×10^{-5} m/s then

A. currenty density is $2.4 \times 10^{+5} A/m^2$

B. current density is $1.6 \times 10^{+4} A/m^2$

C. number of free electrons per unit volume is $2.7 \times 10^{16} m^{-3}$

D. number of free electrons per unit volume is $8.8 \times 10^{28} m^{-3}$

Answer: A::D

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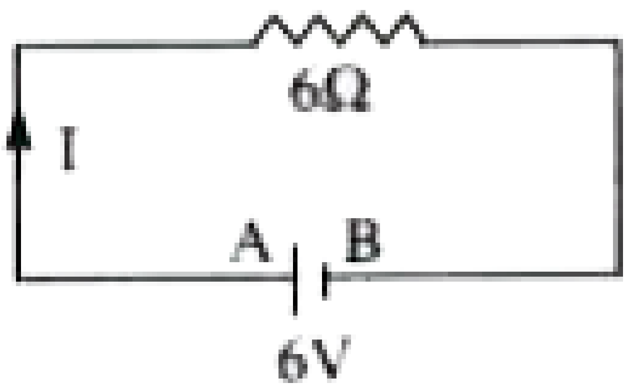
4. In the given circuit, AB is a wire of resistance 6Ω, length 10 cm, number of electrons per unit volume in meterial of wire is $10^{29}m^{-3}$. If cross-sectional area of wire is $1mm^2$, then which of the following options are correct?



A. Energy absorbed by electrons is $2 \times 10^{-17} J$

B. Ohmic loss in wire is $16 J / s$

C. Ohmic loss in wire is $6 J / s$

D. Energy absorbed by electrons is $2 \times 10^{-16} J$

Answer: A::C

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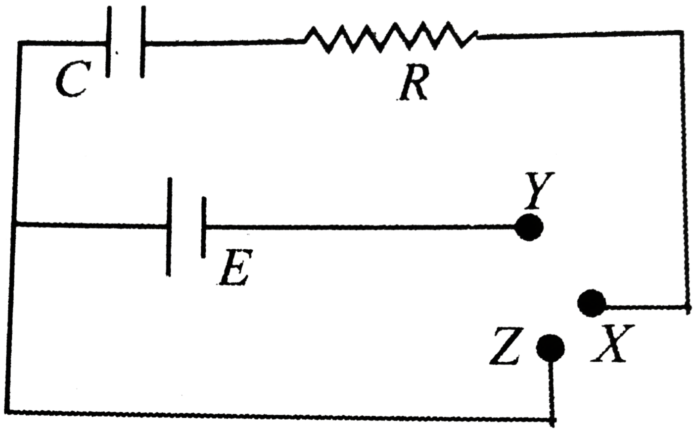
5. The capacitor C is initially without charge. X is now joined to Y for a long time, during which H_1 heat is produced in the resistance R. X is now joined to Z for a long time, during which H_2 heat is produced in R



A. $H_1 = H_2$

B. $H_1 = \frac{1}{2} H_2$

C. $H_1 = 2H_2$

D. The maximum energy stored in C at any time is H_1.

Answer: A::D

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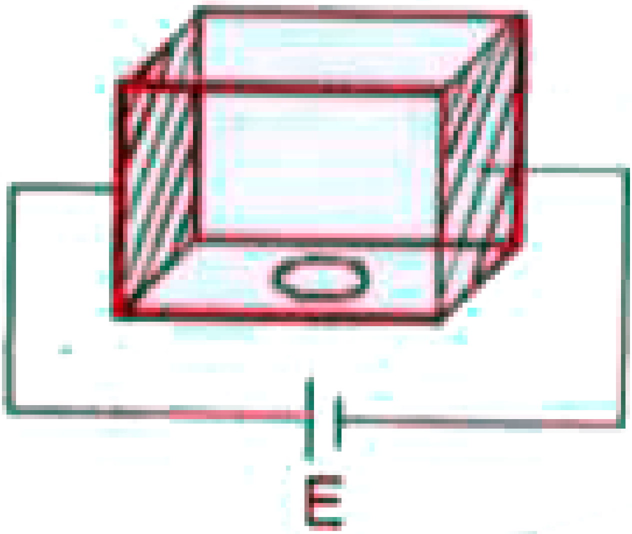
ADDITIONAL PRACTICE EXERCISE (LEVEL -II PRACTICE SHEET (ADVANCED) (Linked Comprehension Type Questions))

1. Passage-I :

A hollow cube of side L has two parallel sides conducting and remaining four sides are non conducting. It is filled with a liquid of dielectric constant K. A small hole of area A at bottom of cube is open at t = 0 and liquid starts leaking throught it. The two conducting sides are connected by a battery of emf E

$$\left(L = 9mA = \frac{18}{\sqrt{20}}m^2 k = 10E = 81v, g = 10m/\sec\right)$$



Capacitance of capacitor as a function of time

A. $\left[3 - \frac{t}{3}\right]^2$

B. $\left[3 - \frac{t}{9}\right]^2$

C. $(3 - t)^2$

D. $\left[3 - \frac{t}{4}\right]^2$

Answer: B

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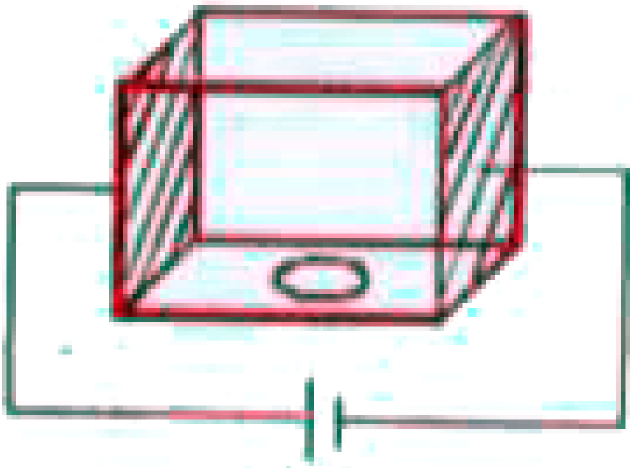
2. Passage-I :

A hollow cube of side L has two parallel sides conducting and remaining four sides are non conducting. It is filled with a liquid of dielectric constant K. A small hole of area A at bottom of cube is open at t = 0 and liquid starts leaking throught it. The two conducting sides are connected by a battery of emf E

$$\left(L = 9mA = \frac{18}{\sqrt{20}}m^2k = 10E = 81v,\, g = 10m\,/\,\sec\right)$$



Capacitance of capacitor as a function of time

A. $\frac{\epsilon_0}{9}\left(t^2 - 54t + 64\right)$

B. $\frac{\epsilon_0}{9}\left(t^2 - 54t + 810\right)$

C. $\frac{\epsilon_0}{9}\left(t^2 + 54t + 810\right)$

D. $\frac{\epsilon_0}{9}\left(t^2 + 54t + 64\right)$

Answer: B

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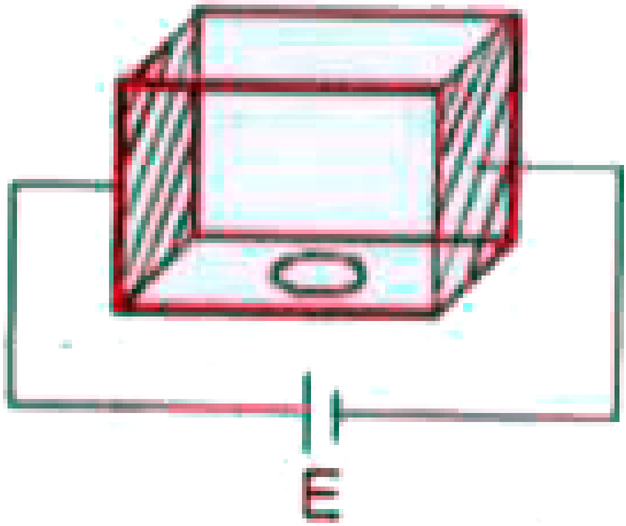
3. Passage-I :

A hollow cube of side L has two parallel sides conducting and remaining four sides are non conducting. It is filled with a liquid of dielectric constant K. A small hole of area A at bottom of cube is open at t = 0 and liquid starts leaking throught it. The two conducting sides are connected by a battery of emf E

$$\left(L = 9mA = \frac{18}{\sqrt{20}}m^2k = 10E = 81v,\ g = 10m/\sec\right)$$



Current through the connecting wire of a time is given by

A. $\in_0 (54 - 2t)$

B. $9 \in_0 (54 + 2t)$

C. $9 \in_0 (54 - 2t)$

D. $\dfrac{\in_0}{9} (54 - 2t)$

Answer: C

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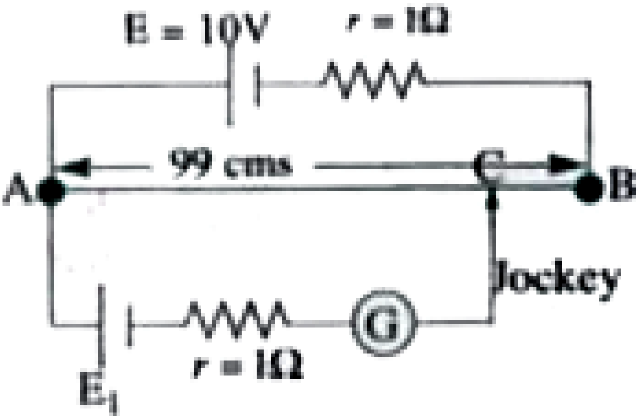
4. Passage - II :

Consider a potentiometer arrangement having auniform wire AB of resistance 99Ω



A driving battery of 10V emf and 1Ω internal resistance is used in the potentiometer. A cell of unknown emf E_1 and internal resistance of 1Ω is balanced agains AC length of potentiometer wire.

When jockey is touched with wire AB at point C such that AC = 40 cm, there is no deflection in galvanometer. The emf of cell is

A. 4V

B. 5V

C. $\frac{5}{4}V$

D. 6V

Answer: A

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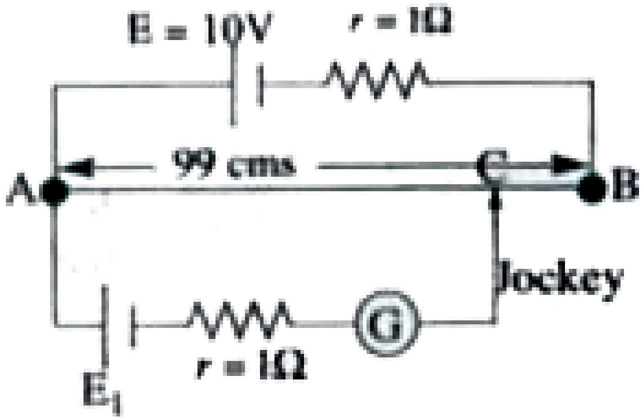
5. Passage - II :

Consider a potentiometer arrangement having auniform wire AB of resistance 99Ω



A driving battery of 10V emf and 1Ω internal resistance is used in the potentiometer. A cell of unknown emf E_1 and internal resistance of 1Ω is balanced agains AC length of potentiometer wire.

When jockey is touched with wire AB at point C such that AC = 40 cm, there is no deflection in galvanometer.

The emf of cell is

A. 6.93V

B. 8.93V

C. 9.93V

D. 0V

Answer: A

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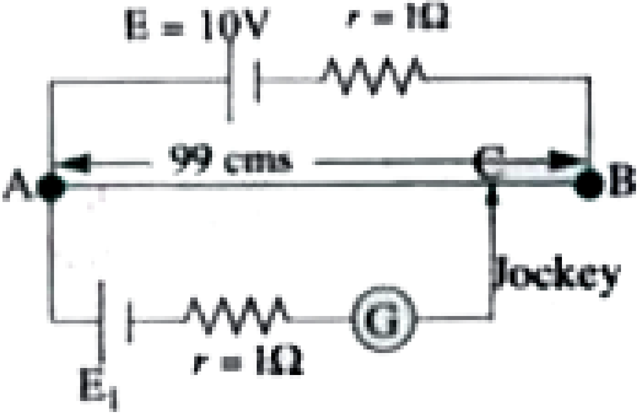
6. Passage - II :

Consider a potentiometer arrangement having auniform wire AB of resistance 99Ω



A driving battery of 10V emf and 1Ω internal resistance is used in the potentiometer. A cell of unknown emf E_1 and internal resistance of 1Ω is balanced agains AC length of potentiometer wire.

When jockey is touched with wire AB at point C such that AC = 40 cm, there is no deflection in galvanometer. The emf of cell is

A. 3V

B. 2.5V

C. 2v

D. None of these

Answer: D

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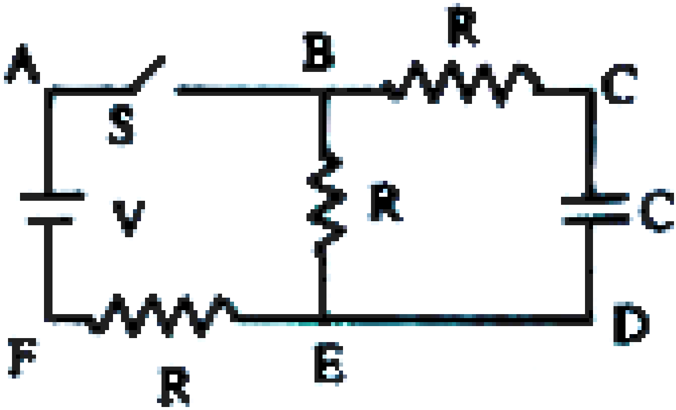
7. Passage-III

In the circuit shown, the battery is ideal with emf V. The capacitor is initially uncharged. The switch is closed at time t = 0



The current in the branch BE at $t = \infty$ is

A. $\frac{VC}{2}\left(1 - e^{-2t/3RC}\right)$

B. $\frac{VC}{2}\left(1 - e^{-t/3RC}\right)$

C. $\frac{VC}{3}\left(1 - e^{-2t/3RC}\right)$

D. $\frac{VC}{3}\left(1 - e^{-t/3RC}\right)$

Answer: A

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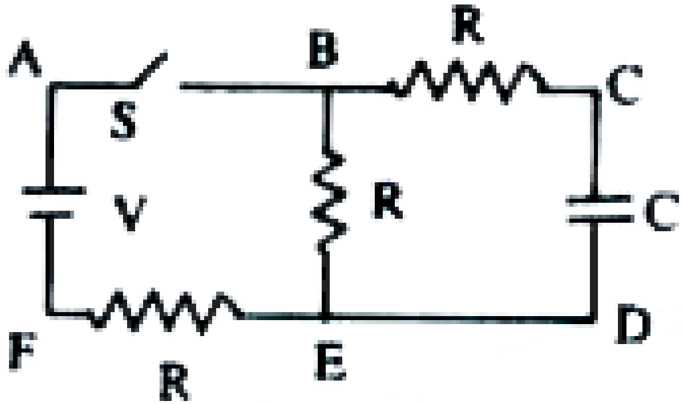
8. Passage-III

In the circuit shown, the battery is ideal with emf V. The capacitor is initially uncharged. The switch is closed at time t = 0



The current in branch containing capacitors at any time t is

A. $\frac{V}{3R}e^{-2t/3RC}$

B. $\frac{V}{2R}e^{-2t/3RC}$

C. $\dfrac{V}{3R}e^{-t/3RC}$

D. $\dfrac{V}{2R}e^{-t/3RC}$

Answer: A

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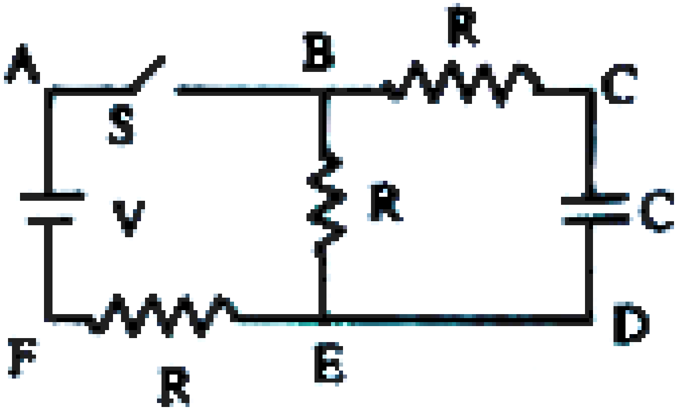
9. Passage-III

In the circuit shown, the battery is ideal with emf V. The capacitor is initially uncharged. The switch is closed at time t = 0



The current in the branch BE at $t = \infty$ is

A. $\dfrac{V}{2R}$

B. $\dfrac{V}{3R}$

C. $\dfrac{2V}{3R}$

D. $\dfrac{3V}{R}$

Answer: A

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PROBLEMS

1. A total of 6.0×10^{16} electrons pass through any cross - section of a conducting wire per second. Find the current.

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2. In a hydrogen atom, electron moves in an orbit of radius 5×10^{-11} m with a speed of 2.2×10^{6} m/s . Calculate the equivalent current.

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3. The current through a wire depends on time as $i = i_0 + \alpha t$, where $i_0 = 10A$ and $\alpha = 4A/s$. Find the charge crossed through a section of the wire in 10 seconds.

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4. A current is established in a discharge tube of cross section $8 \times 10^{-4} m^2$ when a sufficiently high potential difference (say 32 kV) is applied across the two electrodes in the tube. The gas ionises, electrons move towards the positive terminal and positive ions towards the negative terminal. What are the magnitude and sense of the current in a hydrogen discharge tube in which 3×10^{18} electrons and 2×10^{18} protons move past the cross - sectional area of the tube in each second?

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5. Consider a wire of length 4m and cross - sectional area $1mm^2$ carrying a current of 2A. If each cubic metre of the material contains 10^{29} free electrons, find the average time taken by an electron to cross the length of the wire.

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6. Potential difference of 100 V is applied to the ends of a copper wire one metre long. Calculate the average drift velocity of the electrons ? Compare it with thermal velocity at $27^\circ C$. Consider there is one conduction electron per atom. The density of copper is 9.0×10^3, Atomic mass of copper is 63.5g. Avogadro's number $= 6.0 \times 10^{23}$ per gram - mole. Conductivity of copper is $5.81 \times 10^7 \Omega^{-1}$. Boltzmann constant $= 1.38 \times 10^{-23} KJ^{-1}$.

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7. A wire has a resistance of 2.5Ω at $100^\circ C$. Temperature coefficient of resistance of the material

$\alpha = 3.6 \times 10^{-3} K^{-1}$. Find its resistance at $0^\circ C$.

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8. The temperature coefficient of resistance of platinum is $\alpha = 3.92 \times 10^{-3} K^{-1}$ at $0^\circ C$. Find the temperature at which the increase in the resistance of platinum wire is 10% of its value of $0^\circ C$.

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9. Resistance of a wire at temperature $t^\circ C$ is $R = R_0 (1 + at + bt^2)$ Here, R_0 is the temperature at

$0^{\circ} C$. Find the temperature coefficient of resistance at temperature t is

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10. A silver wire has a resistance of 2.1Ω at $27.5^{\circ} C$, and a resistance of 2.7Ω at $100^{\circ} C$. Determine the temperature coefficient of resistivity of silver.

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11. A heating element using nichrome connected to a 230V supply draws an initial current of 3.2 A which settles after a few seconds to a steady value of 2.8A.

What is the steady temperture of the heating element if the heating the room temperature is $27.0^\circ C$? Temperature coefficient of resistance of nichrome averaged over the temperature range involved is $1.70 \times 10^{-4}.^\circ C^{-1}$.

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12. V - I graph of a conductor at temperature T_1 and T_2 are shown in the figure $(T_2 - T_1)$ is proportional to

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13. A wire of silver has a resistance of 1 ohm. Specific resistance of constantan is 30 times the specific resistance of silver. Find the resistance of a constantan wire whose length is one third length of the silver wire and radius half the radius of the silver wire.

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14. A rectangular block has dimensions 5 cm $\times$ 5 cm $\times 10cm$. Calculate the resistance measured between (a) two square ends and (b) the opposite rectanglar ends specific resistance of the material is $3.5 \times 10^{-5}\ \Omega$ m

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15. Two wires of same material have their lengths in the ratio 2:3 and radii 8:9 . Equal value of p.d is applied between their ends (separately). Calculate the ratio of current through those two

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16. Figure shows a conductor of length l having a circular cross - section. The radius of cross - section varies linearly from a to b. The resistivity of the materia is ρ. Assuming that $b-a < \; < l$, find the resistance of the conductor.

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17. Two wires A and B of same mass and material are taken. Diameter of wire A is half of wire B. If resistance of wire A is 24Ω find the resistance of wire B.

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18. What will be the resistance of a semi circle shown in fig., between its two end faces. Given that radial thickness is 3cm, axial thickness is 4 cm, inner radius is 6 cm and specific resistance is 4×10^{-6} ohm $-cm$

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19. A hollow cylinder of specific resistance ρ, inner radius R, outer radius 2R and length l is as shown in figure. What is the net resistance between the inner and outer surface?

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20. There are two concentric spheres of radius (a) and (b) respectively. If the space between them is filled with medium of resistivity ρ, then the resistance of the intergap between the two spheres will be

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21. A hollow copper cylinder is of inner radius 4cm and outer radius 5cm. Now hollow portion is completely filled with suitable copper wires. Find percentage change in its electric resistance.

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22. Resistivity of the material of a conductor of uniform cross-section varies along its length as $\rho = \rho_0(1 + \alpha x)$. Find the resistance of the conductor, if its length is l and area of corss-section A.

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23. How many number of turns of nichrome wire of specific resistance $10^{-6}\Omega m$ and diameter 2mm that should be wound on a cylinder of diameter 5cm to obtain a resistance of ?

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24. Suppose the colours on the resistor as shown in Figure are brown, yellow, green and gold as read from left to right. Using the table, find the resistance of the resistor

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25. What is the color code for a resistor of resistance $350 m\Omega$ with 5% tolerance?

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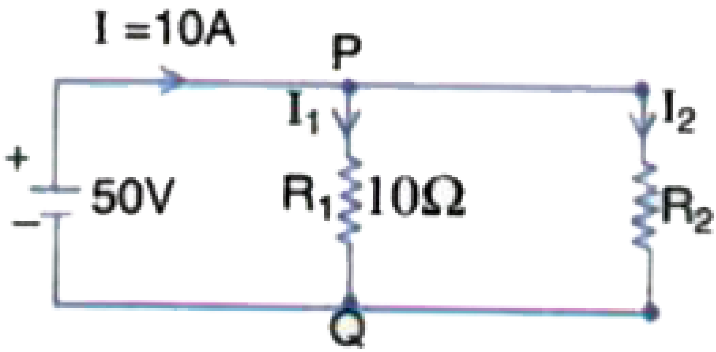
26. For a circuit shown in Fig. find the value of resistance R_2 and current I_2 flowing through R_2



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27. Two wires of equal diameters of resistivities p_1 and p_2 and lengthx_1 and x_2 respectively are joined in series. The equivalent resistivity of the combination is

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

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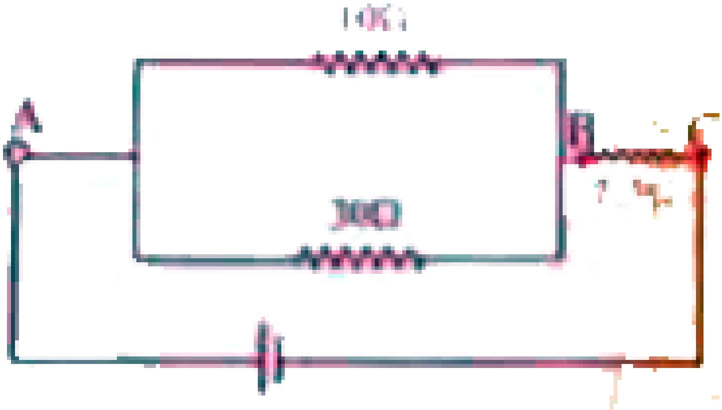
29. Find equivalent resistance of the network in Fig. between points (i) A and B and (ii) and C.



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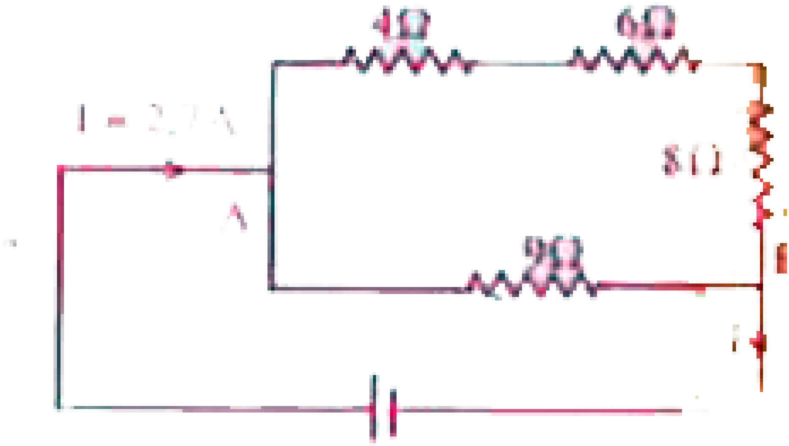
30. Find potential difference between points A and B of the network shown in Fig. and distribution of given main current through different resistors.



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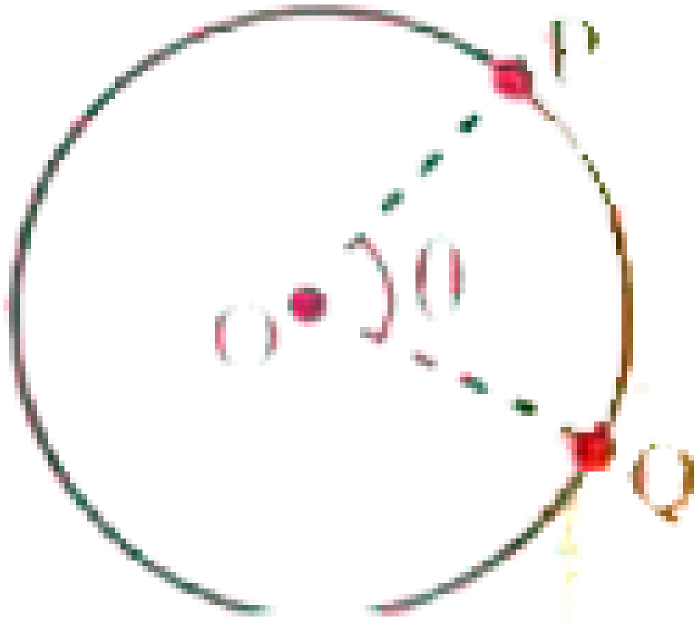
31. P and Q are two points on a uniform ring of resistance R. The equivalent resistance between P and

Q is



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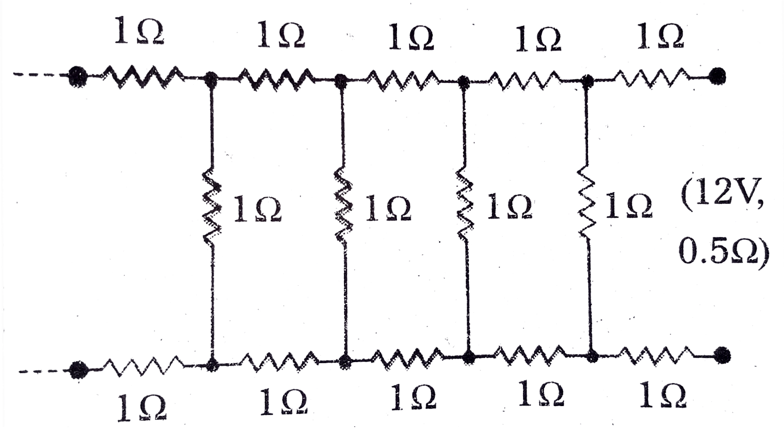
32. Determine the current drawn from a 12 V supply with internal resistance 0.5Ω by the infinite network shown in Fig. Each resistor has 1Ω resistance.



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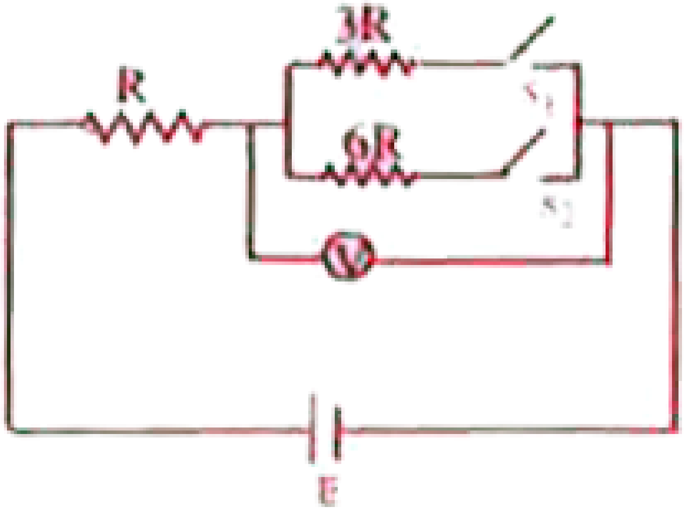
33. In the circuit shown in figure reading of voltmeter is V_1 when only S_1 is closed, reading of voltmeter is V_2 when only S_2 is closed and reading of voltmeter is V_3 when both S_1 and S_2 are closed. Then



1) $V_3 > V_2 > V_1$

2) $V_2 > V_1 > V_3$

3) $V_3 > V_1 > V_2$

4) $V_1 > V_2 > V_3$

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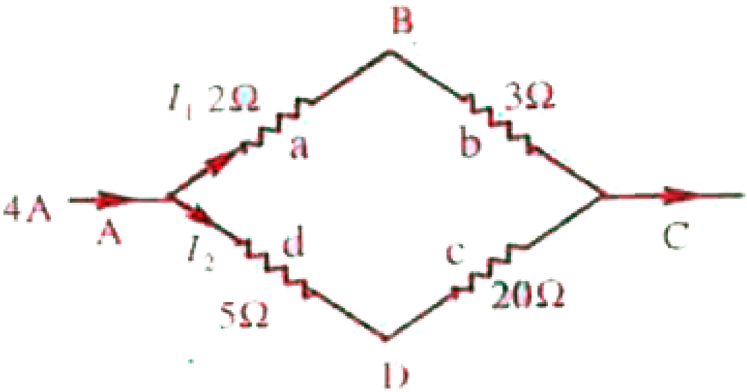
34. In the given network, calculate the potential difference between the points B and D



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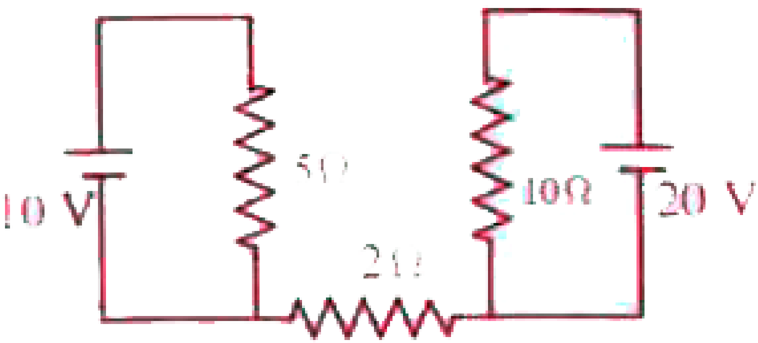
35. Find out the value of current through 2Ω resistance for the given circuit.



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36. A 1kW heater is meant to operate at 200 V. (a) What is its resistance ? (b) How much power will it consume if the line voltage drops to 100 V ? (c) How many units of electrical energy will it consume in a month (of 30 days) if it operates 10 hr daily at the specified voltage?

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37. Three equal resistors connected in series across a source of emf together dissipate 10 watt of power. What would be the power dissipated if the same

resistances are connected in parallel acrsoss the same source of emf?

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38. To boil a certain mass of water, a coil will take a time of t_1 and another coil will take a time of t_2. What will be the time taken when the coils are connected in (i) series (ii) in paralle?

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39. A lamp of 100 W works at 220 volts. What is its resistance and current capacity?

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40. A $100W - 220V$ bulb is connected to 110 V source. Calculate thepower consumed by the bulb.

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41. A 100 W and a 500 W bulbs are joined in series and connected to the mains. Which bulb will glow brigher ?

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42. A cell develops the same power across two resistance R_1 and R_2 separately. The internal resistance of the cell is

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43. A wire of length L and 3 identical cells of negligible internal resistance are connected in series. Due to the current, the temperature of the wire is raised by Δt in a time t. A number N of similar cells is now connected in series with a wire of the same material and cross-section but of length 2L. The temperature of the wire is raised by the same amount Δt in the same time t. The value of N is

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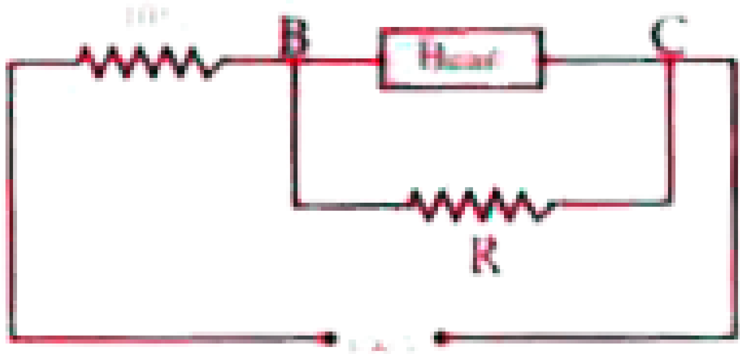
44. A heater is designed to operate with a power of 1000 watt in a 100 V line. It is connected in combination with a resistance of 10Ω and a resistance R. to a 100 V mains as shown in the figure. What will be the value of R so that the heater operates with a power of 62.5 W?



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45. In the circuit shown in figure the heat produced in the 5 ohm resistor due to the current flowing through it is 10 calorie per second. The heat generated in the 4 ohm resistor is

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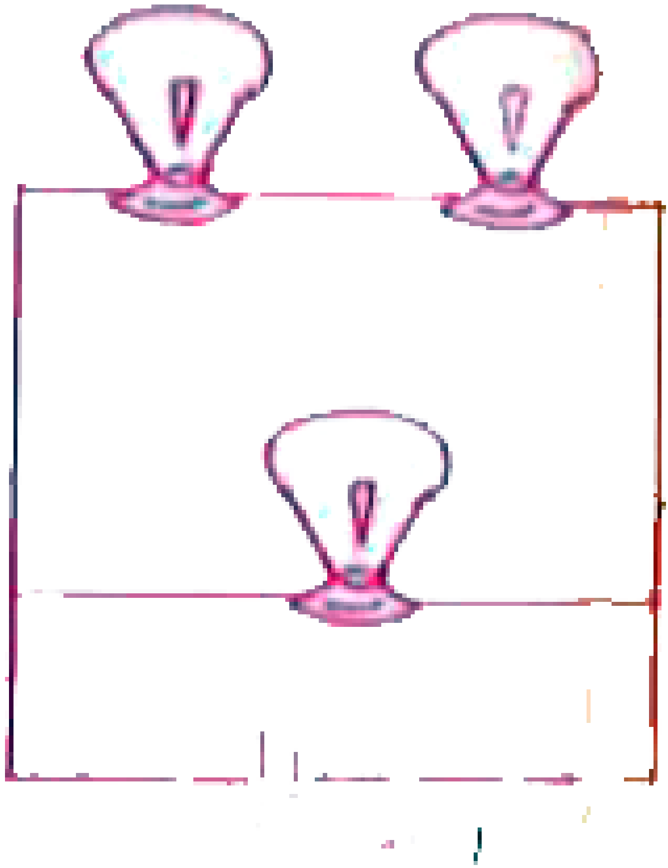
46. A 100 W bulb B_1 and two 60 W bulbs B_2 and B_3 are connected to a 250 V source, as shown in the figure. Now W_1, W_2 and W_3 are the output powers of the bulbs $B_1 B_2$ and B_3 respectively. Then



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47. An electric bulb rated for 500 watt at 100 volt is used in a circuit having a 200 volt supply. The resistance R that must be put in series with the bulb, so that the bulb delivers 500 watt is .... Ohm.

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48. An electric tea kettle has two heating coils. When one of the coils is switched on, boiling begins in 6 min. When the other coil is switched on, the boiling begins in 8 min. In what time, will the boiling begin if both coils are switched on simultaneously (i) in series and (ii) in parallel.

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49. If two bulbs of 25 W and 100 W rated at 220 V are connected in series across 440 V supply. Will both the bulbs fuse? If not which one?

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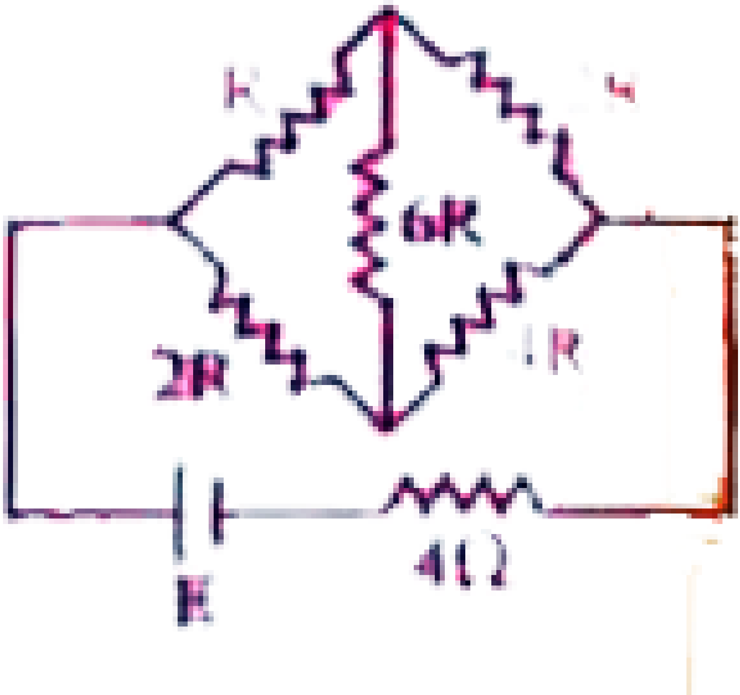
50. A battery if internal resistance 4Ω is connected to the network of ressitances as shown. What must be the value of R so that maximum power is delivered to the network? Find the maximum power?



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51. A fuse wire with radius of 0.2mm blows off with a current of 5 Amp. The fuse wire of same material, but of radius 0.3 mm will blow off with a current of

1) $5 \times \frac{3}{2}$ Amp

2) $\frac{5\sqrt{3}}{2}$ Amp

3) $5\sqrt{\frac{27}{8}}$ Amp

4) 5 Amp

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52. A battery of emf 10 V and internal resistance 3Ω is connected to a resistor. If the current in the circuit is 0.5 A, what is the resistance of the resistor? What is the terminal voltage of the battery when the circuit is closed?

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53. When a current drawn from a battery is 0.5A, its terminal potential difference is 20V. And when current drawn from it is 2.0A, the terminal voltage reduces to 16V. Find out, e.m.f and internal resistance of the battery.

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54. An ideal battery passes a current of 5A through a resistor. When it is connected to another resistance of 10Ω in parallel, the current is 6A. Find the resistance of the first resistor.

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55. When a resistor of 11Ω is connected in series with an electric cell in series, the current increases by 0.4 A. The internal resistance of the cell is

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56. When a battery is connected to the resistance of 10Ω the current in the circuit is 0.12 A. The same battery gives 0.07A current with 20Ω Calculate e.m.f. and internal resistance of the battery.

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57. The potential difference across the terminals of battery is 10 V when there is a current of 3A in battery from the negative to the positive terminate when the current is 2A in the reverse direction, potential difference becomes 15 V. The inter resistance of the battery is

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58. Two cells A and B with same e.m.f of 2 V each and with internal resistances $r_A = 3.5\Omega$ and $r_B = 0.5\Omega$ are connected in series with an external resistance $R = 3\Omega$. Find the terminal voltage across the two cells.

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59. Two cells A and B each of 2V are connected in series to an external resistance R = 1 ohm. The internal resistance of A is $r_A = 1.9$ ohm and B is $r_B = 00.9$ ohm. Find the potential difference between the terminals of A.

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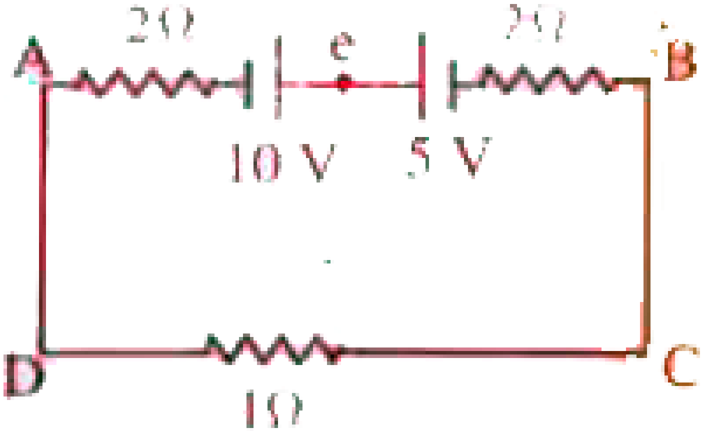
60. In the given circuit as shown below, calculate the magnitude and direction of the current



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61. Two batteries each of emf E and internal resistance r are connected in series and in parallel, and are used to find current in an external resistance R. If the current in series is equal to that in parallel, the internal resistance of each battery is

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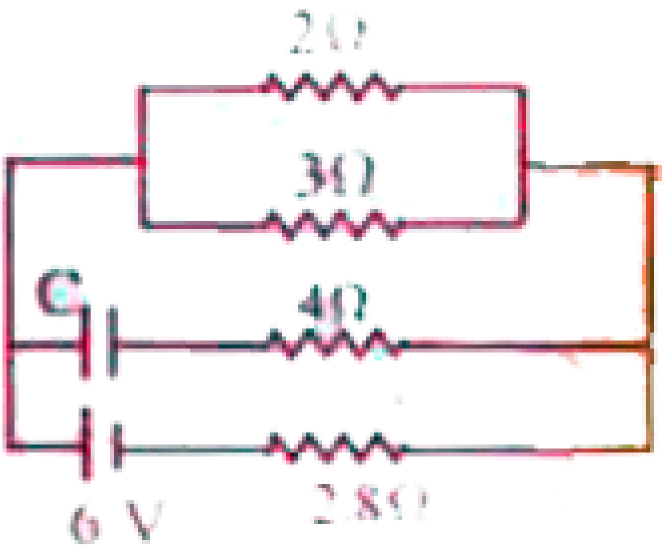
62. In the steady state of the below given circuit, find the charge on the capacitor of capacity $0.2\mu F$.



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63. Tweleve celles each having the same emf are connected in series and are kept in a closed box. Some of the cells are wrongly connected. This battery is connected in series with an ammeter and two cells identical with each other. The current is 3A when the cells and battery aid each other and 2A when the cells and battery oppose each other. How many cells are wrongly connected?

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64. A voltmeter with resistance 500Ω is used to measure the emf of a cell of internal resistance 4ω, percentage error in the reading of the voltmeter will be

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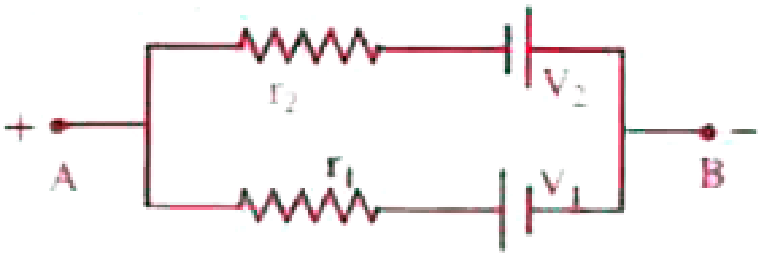
65. Find the emf (V) and internal resistance (r) of a single battery which is equivalent to a parallel combination of two batteries of emfs V_1 and V_2 and internal resistances r_1 and r_2 respectively, with polarties as shown in figure



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66. Consider the network as shown in Fig. Current is supplied to the network by two batteries as shown.

Find the values of currents I_1, I_2, I_3. The direction of the currents are as indicated by the arrows.

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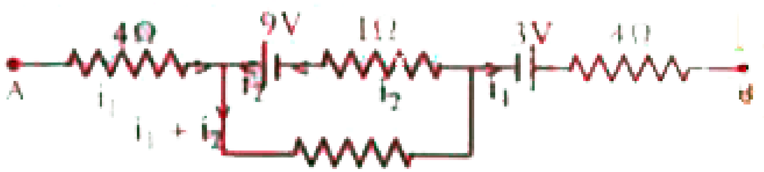
67. For the circuit shown in the figure, potential difference between points A and B is 16 V. Find the current passing through 2Ω.



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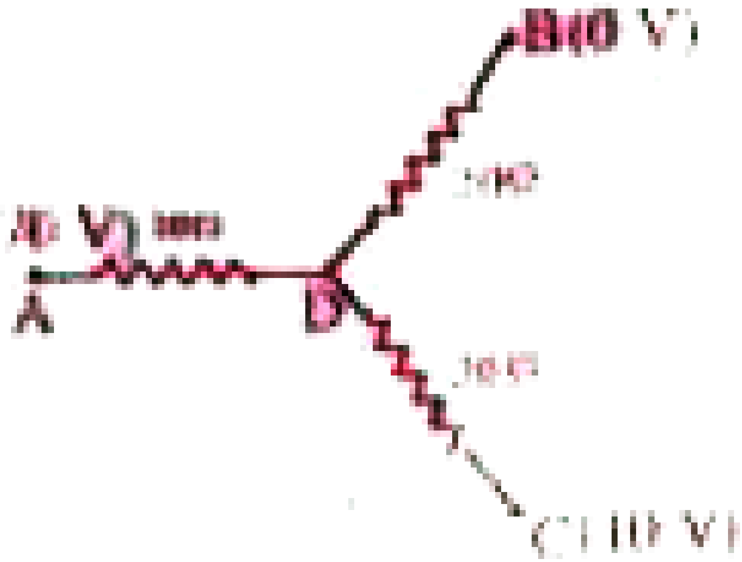

68.

In the network shown A, B and C are at potentials of 70 V, zero V and 10 V respectively. The false one is

1) Point D is at a potential of 40 V

2) The currents in the sections AD, DB, DC are in the ratio $3:2:1$

3) The current in the section AD, DB, DC are in the ratio

$1 : 2 : 3$

4) The network draws a total power of 200 W

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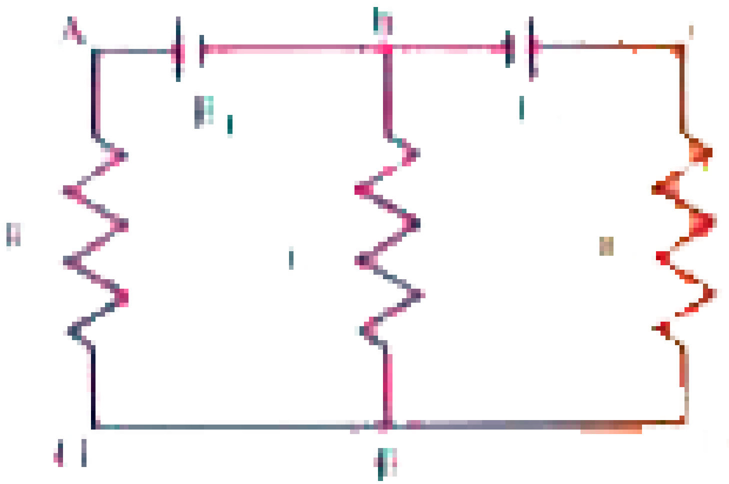
69. In the given circuit values are as follows $\varepsilon_1 = 2V, \varepsilon_2 = 4V, R_1 = 1\Omega$ and $R_2 = R_3 = 1\Omega$. Calcualte the Currents through R_1, R_2 and R_3.



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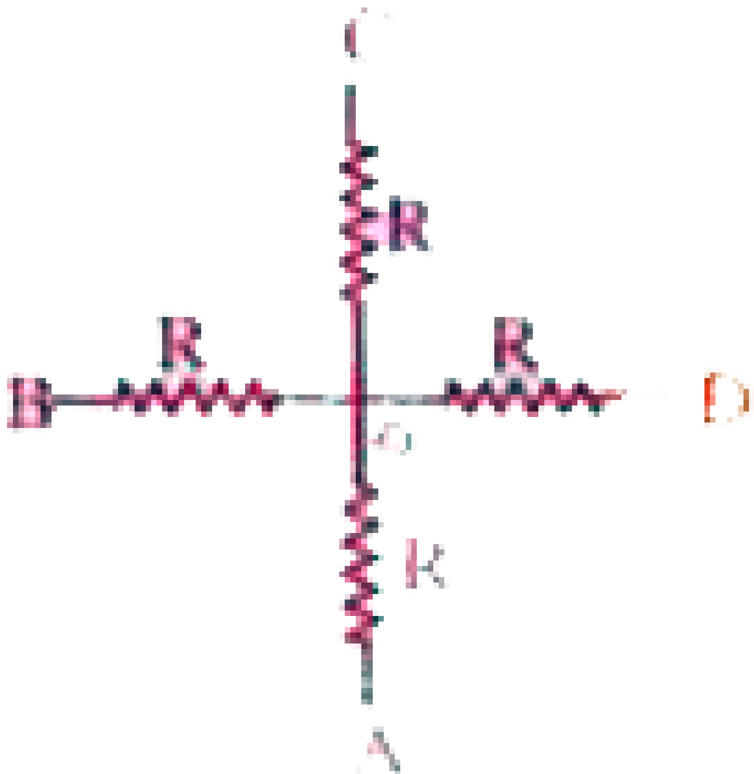
70. The given four terminal net work is a part of larger circuit. The points A, B, C are at the same potential. The P.E. between any one of A, B or C and D is 40 V. Find the P.D. between A & O.



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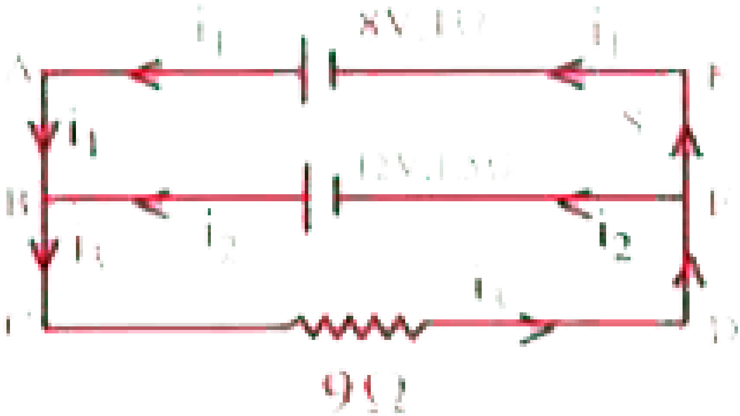
71. Solve for current values in figure.



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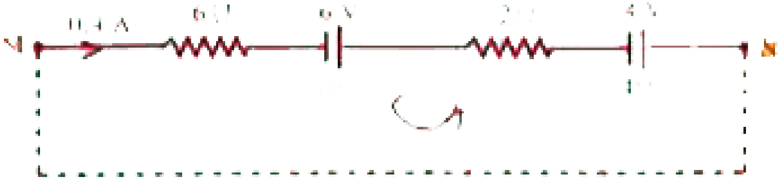
72. Find the potential difference between and N in the given branch of a circuit figure.



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73. Two cells E_1 (with emf 4V and internal resistance 2Ω) and E_2 (with emf 2V and intenral resistnace 2Ω) are connected in parallel. The combination is connected in parallel with a 8Ω resistance R as shown in figure. Calcualte the currents passing through 2V cell and through the resistance R.

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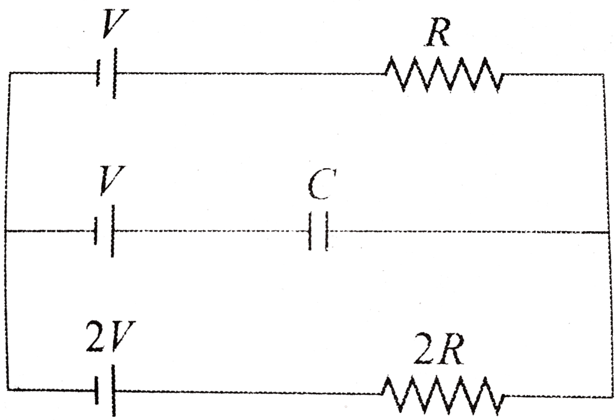
74. In the given circuit, with steady current, the potential drop across the capacitor must be



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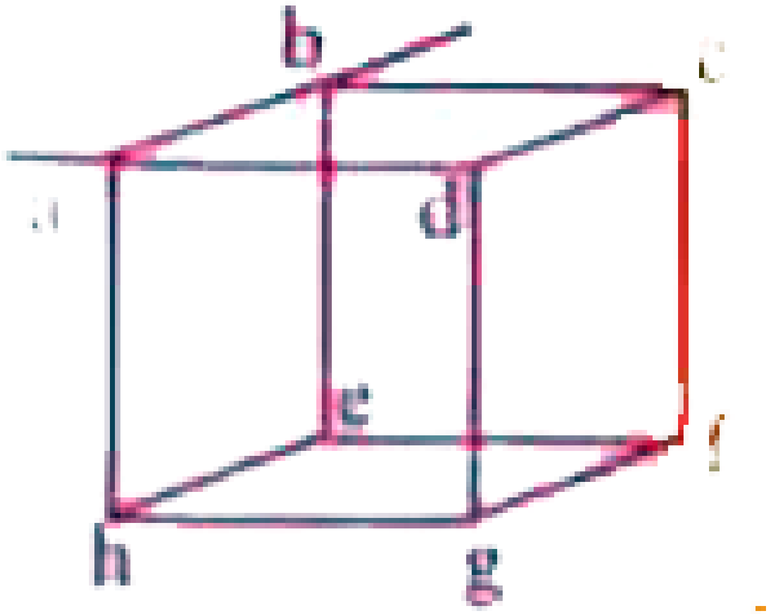
75. Find the equivalent resistance of the circuit of the previous problem between the ends of an edge such as a and b in figure.



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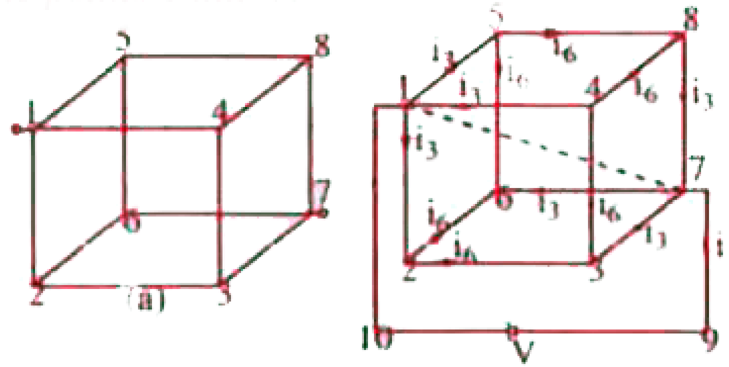
76. Twelve equal wires, each of resistance r ohm are connected so as to form a skeleton cube. Find the equivalent resistance between the diagonally opposite

points 1 and 7.



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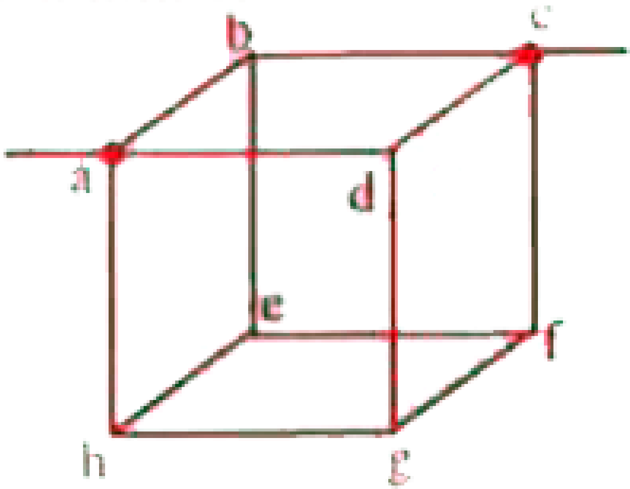
77. Twelve wires, each having resistance r. are joined to form a cube as shown in figure. Find the equivalent resistance between the ends of a face diagonal such as a and c.



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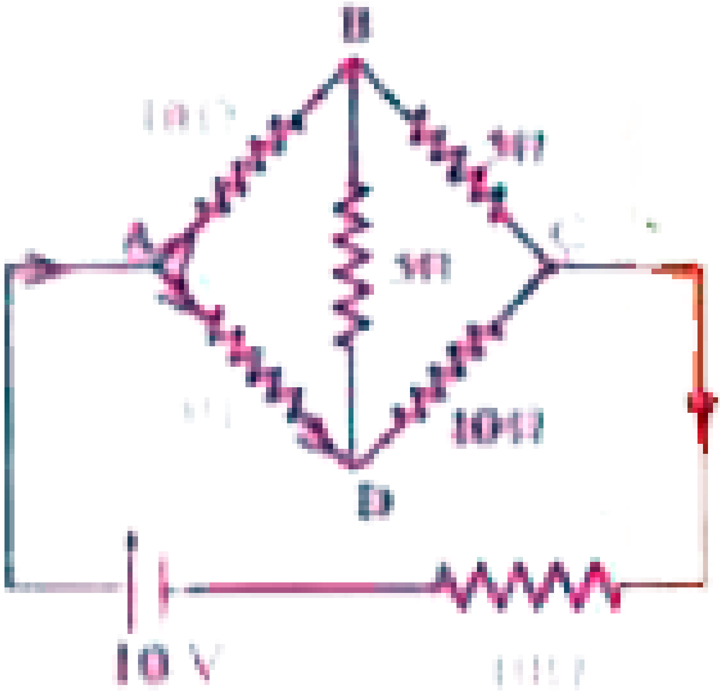
78. Determine the current in each branch of the network shown in fig.



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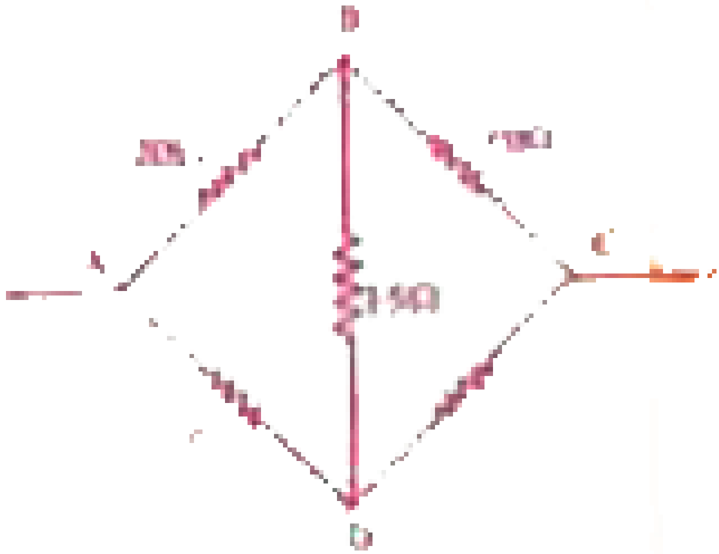
79. Find the value of R in Fig. so that there is no current in the 15Ω resistor.



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80. Find the Equivalent resistance across A and R in the given circuit if $r = 10\Omega, R = 20\Omega$.

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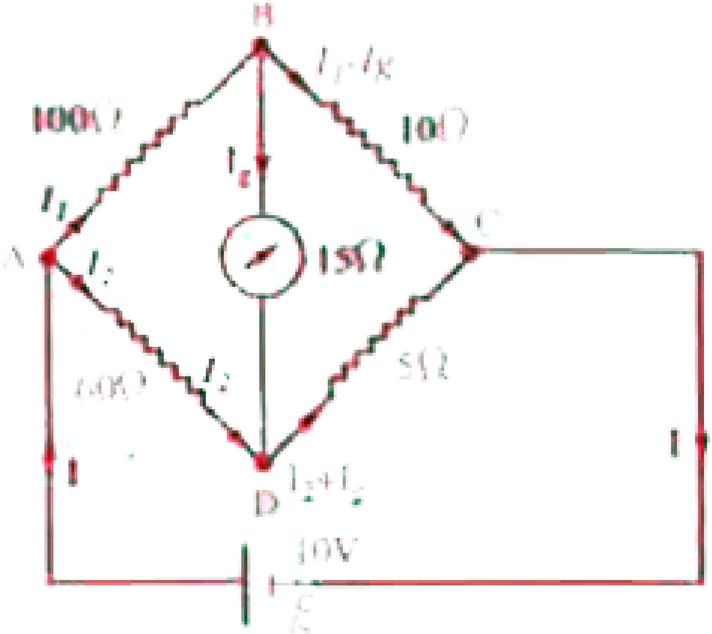
81. The four arms of a Wheastone bridge (Figure) have the following resistance :

$AB = 100\Omega$, $BC = 10\Omega$, $CD = 5\Omega$ and $DA = 60\Omega$



A galvanometer of 15Ω resistance is connected across BD. Calculate the current through the galvano - meter when a potential difference of 10 V is maintained across AC,

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82. Find the effective resistance between P and Q points P and Q of the electrical circuit shown in the figure

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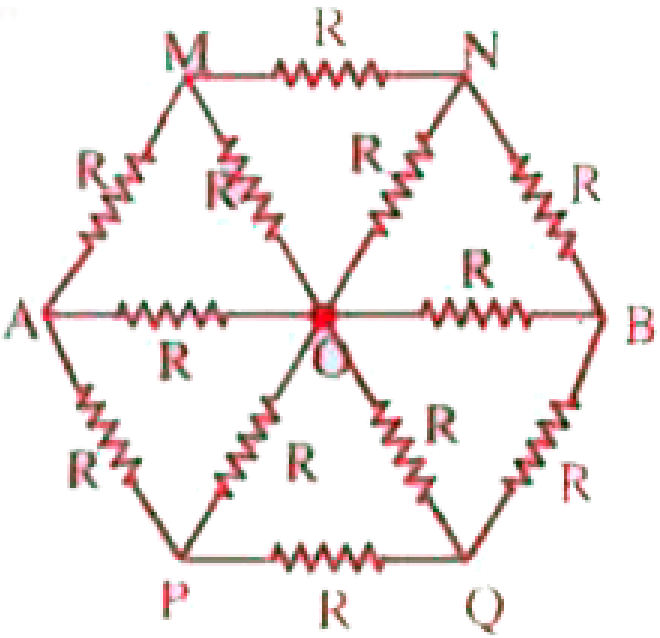
83. Twelve equal resistance are connected as shown in the diagram. Find the effective resistance between A and B



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84. In the given circuit it is observed that the current I is independent of the value of theresistance R_5. Then what is the relation the resistance values must satisfy.

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85. A balance point in a meter bridge experiment is obtained at 30 cm from the left. If right gap contains 3.5Ω, what is the resistance in the left gap?

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86. In a meter bridge (Fig. 3.27), the null point is found at a distance of 33.7 cm from A. If now a resistance of 12Ω is connected in parallel with S, the null point occurs at 51.9 cm. Determine the values of R and S.

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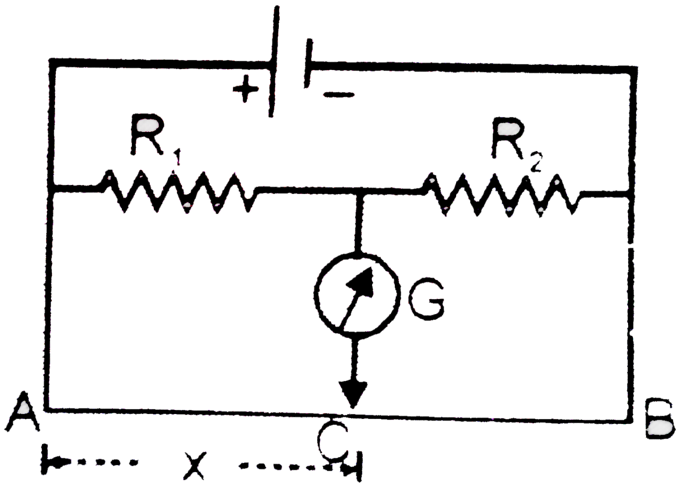
87. In the shown arrangement of the experiment of the meter bridge if AC corresponding to null deflection of galvanometer is x. what would b e its value if the radius of the wire AB is doubled:-



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88. A resistance of 2Ω is connected across one gap of a metre-bridge (the length of the wire is 100 cm) and an unknown resistance, greater than 2Ω, is connected across the other gap. When these resistances are interchanged, the balance point shifts by 20 cm. Neglecting any corrections, the unknown resistance is

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89. The length of a potentiometer wire is 1m and its resistance is 4Ω. A current of 5mA is flowing in it. An unknown source of e.m.f is the source.

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90. A resistance of $R\omega$ draws current from a potentiometer. The potentio - meter has a total resistance $R_0\Omega$ (Fig). A voltage V is supplied to the potentiometer.

Derive an expression for the voltage across R when the sliding contact is in the middle of the potentiometer.

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91. A battery of unknown emf connected to a potentiometer has balancing length 560 cm. If a resistor of resistance 10 ohm, is connected in parallel with the cell the balancing length change by 60 cm. If the internal resistance of the cell is $\frac{n}{10}$ ohm, the value of 'n' is

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92. A cell of e.m.f 2 volt and internal resistance 1.5Ω is connected to the ends of 1m long wire. The resistance of wire is $0.5\Omega/m$. Find the value of potential gradient on the wire.

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93. In a potentiometer experiment when a battery of e.m.f. 2 V is included in the secondary circuit, the balance point is 500 cm. Find the balancing length of the same end when a cadimum cell of e.m.f. 1.018V is connected to the secondary circuit.

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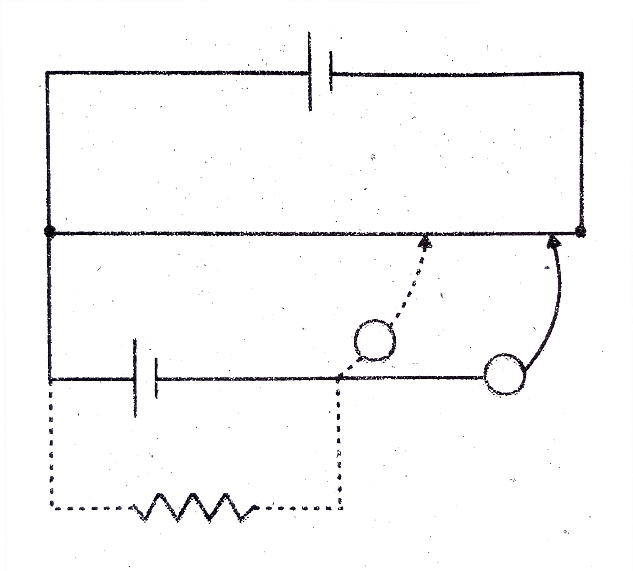
94. Figure shows a 2.0 V potentiometer used for the determination of internal resistance of a 1.5 V cell. The balance point of the cell in open circuit is 76.8 cm. when a resistor of 9.5Ω is used in the external circuit of the cell, the balance point shifts to 64.8 cm length of the potentiometer wire. Determine the internal resistance of the cell.



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EXERCISE - IA

1. Typical drift velocity in conductor wire is $10^{-2} m/s$, i.e. it takes 100 sec to drift 1 m whilebulb glows instantaneously, how

A. The random speed of electrons is very high, of the order of 10^6 m/s

B. The electrons transfer their energy very quickly through collisions

C. Electric field is set up in the wire very quickly, producing a current through each cross section, almost intantaneousty

D. All of above

Answer: C

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2. Mobility of free electrons in a conductor is

A. directly proportional to electron density

B. directly proportional to relaxation time

C. inversely proportional to electron density

D. inversely proportional to relaxation time

Answer: B

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