PHYSICS

BOOKS - SUNIL BATRA 41 YEARS IITJEE PHYSICS (HINGLISH)

CURRENT ELECTRICITY

Jee Main And Advanced

1. An electric bulb rated for 500 watts at 100 volts is used in a circuit having a 200 volts 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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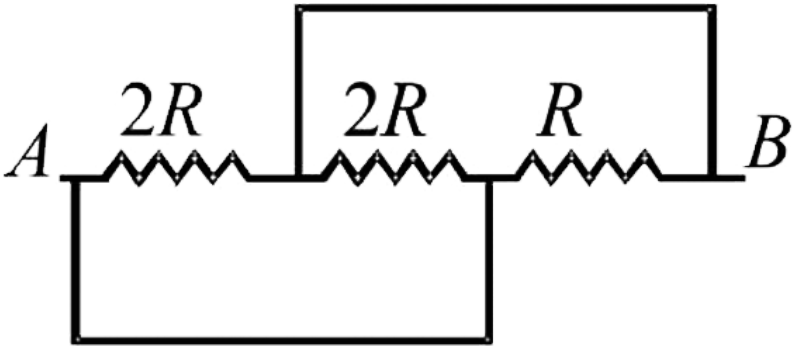
2. The equivalent resistance between points A and B of the circuit given below is .....Ω



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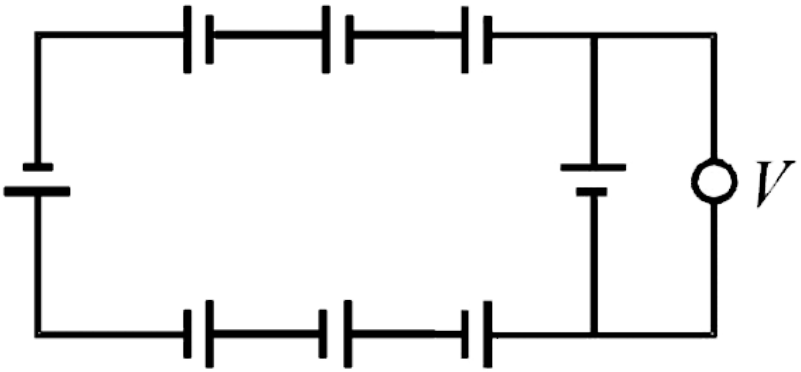
3. In the circuit shown below, each battery is 5V and has an internal resistance of 0.2 ohm.



The reading in the ideal voltmeter V is .

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4. In an electrolytic solution the electric current is mainly due to the movement of free electrons.

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5. Electrons in a conductor have no motion in the absence of a potential difference across it.

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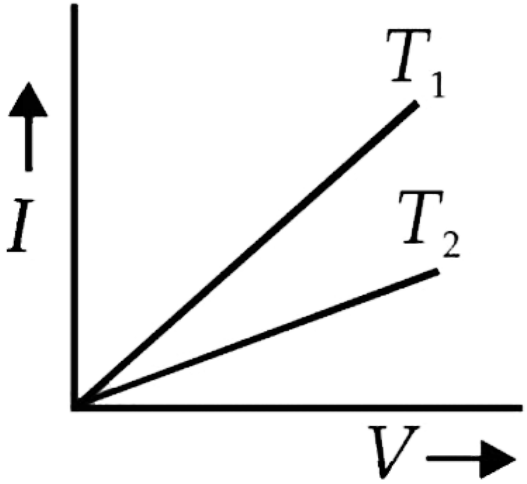
6. The current - voltage graphs for a given metallic wire at two different temperatures T_1 and T_2 are shown in the figure.



The temperature T_2 is greater than T_1.

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7. The temperature coefficient of resistance of a wire is 0.00125 per ^ ∘ C. At 300K, its resistance is 1 ohm. This resistance of the wire will be 2 ohm at.

A. 1154K

B. 1100K

C. 1400K

D. 1127K

Answer: D

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8. A constant voltage is applied between the two ends of a uniform metallic wire. Some heat is developed in it. The heat developed is doubled if

A. both the length and the radius of the wire are halved.

B. both the length and the radius of the wire are doubled.

C. the radius of the wire is doubled.

D. the length of the wire is doubled .

Answer: B

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9. The electrostatic field due to a point charge depends on the distance r as $\frac{1}{r^2}$. Indicate which of the following quantities shows same dependence on r.

A. Intensity of light from a point source

B. Electrostatic potential due to a point charge.

C. Electrostatic potential at a distance r from the centre of a charged metallic spher. Given rlt radius of the sphere.

D. None of these

Answer: A

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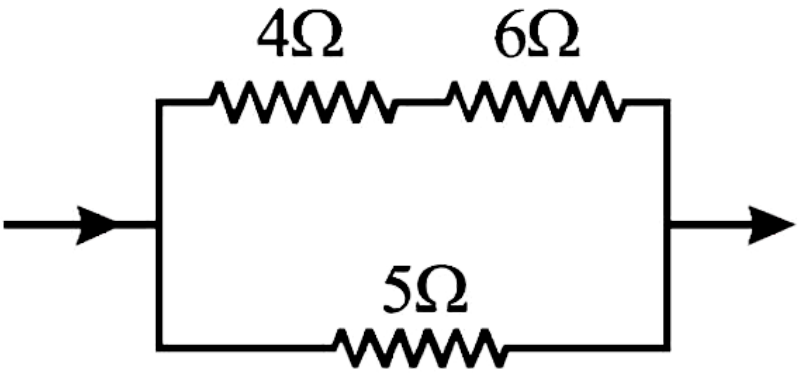
10. In the circuit shown in fig the heat produced in the 5 ohm resistor due to the current flowing through it is 10 calories per second.



The heat generated in the 4 ohms resistor is

A. $1cal/\sec$

B. $2cal/\sec$

C. $3cal/\sec$

D. $4cal/\sec$

Answer: B

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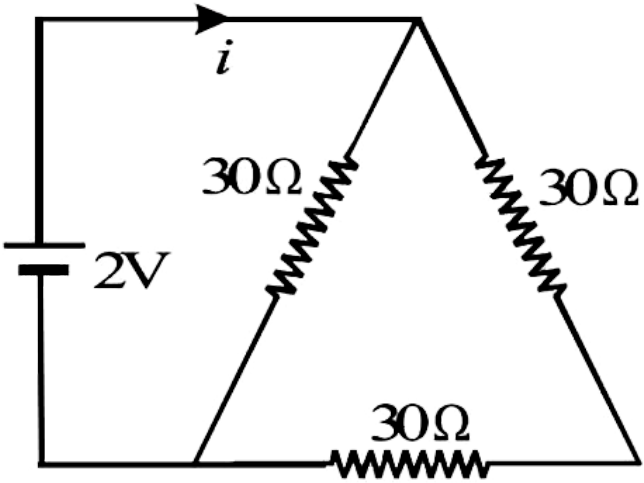
11. The current I in the circuit is



A. 1/45 A

B. 1/15 A

C. 1/10 A

D. 1/5 A

Answer: C

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12. A piece of copper and another of germanium are cooled from room temperature to $80^{\circ} K$. The resistance of

A. each of them increases

B. each of them decreases

C. copper increases and germanium decreases

D. copper decreases and germanium increases.

Answer: D

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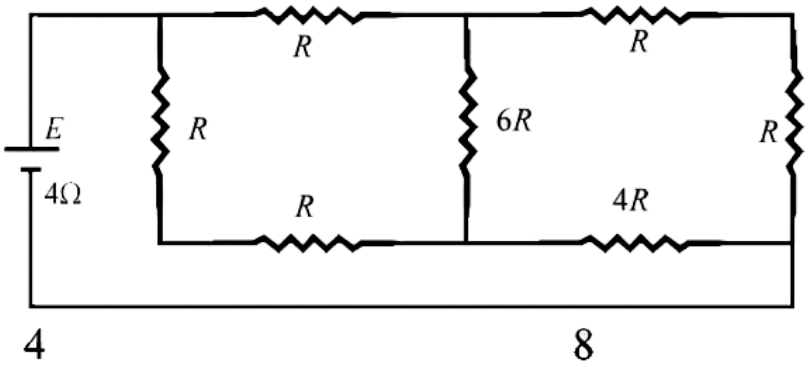
13. A battery of internal resistance 4Ω is connected to the network of resistance as shown . In order that the maximum power can be delivered

to the network, the value of R in Ω should be



A. $\frac{4}{9}$

B. 2

C. $\frac{8}{3}$

D. 18

Answer: B

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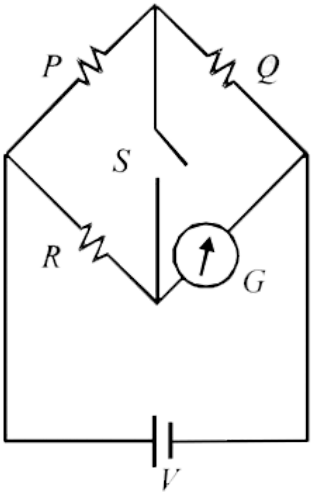
14. In the circuit $P \neq R$, the reading of the galvanometer is same with switch S open or closed. Then



A. $I_R = I_G$

B. $I_P = I_G$

C. $I_Q = I_G$

D. $I_Q = I_R$

Answer: A

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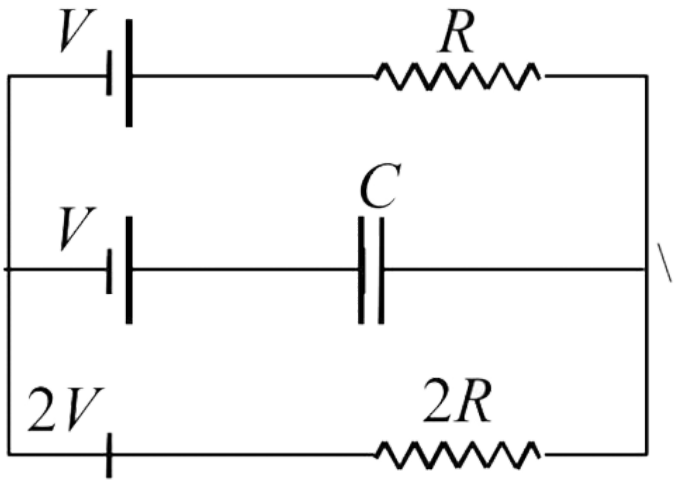
15. In the given circuit, with steady current, the potential drop across the capacitor must be



A. V

B. $V/2$

C. $V/3$

D. $2V/3$

Answer: C

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16. 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

A. 4

B. 6

C. 8

D. 9

Answer: B

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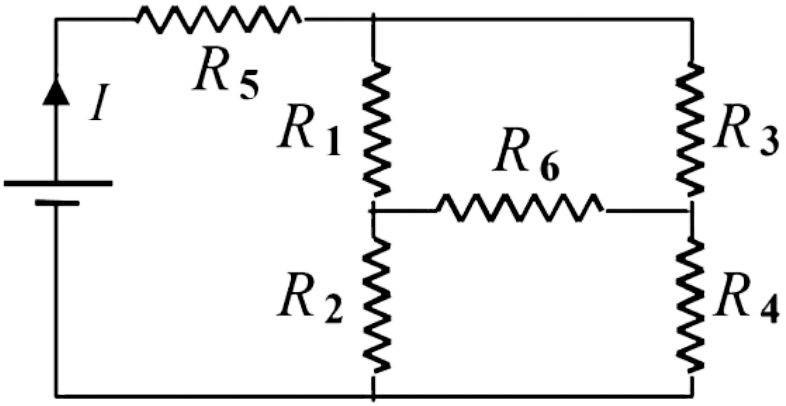
17. In the given circuit, it is observed that the current I is independent of the value of the resistance R_6. Then the resistance values must satisfy



A. $R_1R_2R_5 = R_3R_4R_6$

B. $\frac{1}{R_5} + \frac{1}{R_6} = \frac{1}{R_1 + R_2} + \frac{1}{R_3 + R_4}$

C. $R_1R_4 = R_2R_3$

D. $R_1R_3 = R_2R_4 = R_5R_6$

Answer: C

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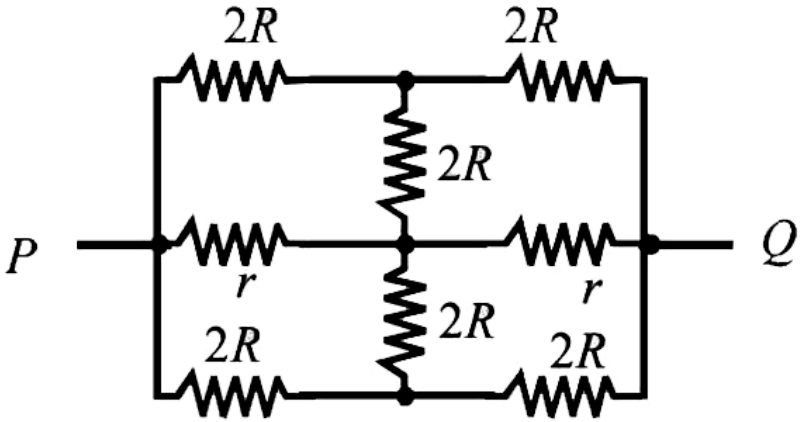
18. The effective resistance between points P and Q of the electrical circuit shown in the figure is

(a) $\frac{2Rr}{R+r}$

(b) $\frac{8R(R+r)}{3R+r}$

© $2r+4R$

(d) $\frac{5R}{2}+2r$.



A. $\frac{2Rr}{R+r}$

B. $\frac{8R(R+r)}{3R+r}$

C. $2r+4R$

D. $\frac{5R}{2}+2r$

Answer: A

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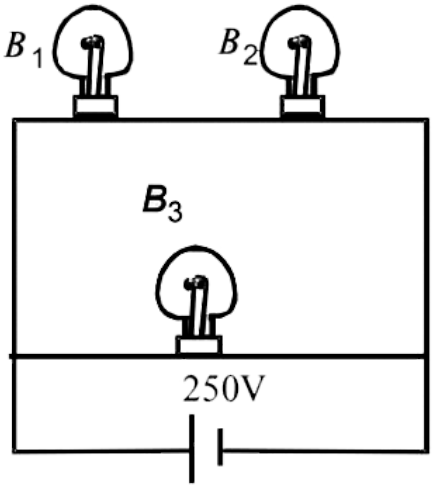
19. A 100 W bulb B_1, and two 60 W bulb B_2 and B_3, are connected to a 250 V source, as shown in figure. Now W_1, W_2 and W_3 are the output powers of the bulbs B_1, B_2 and B_3, respectively. Then



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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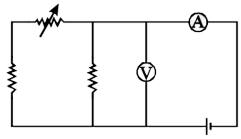
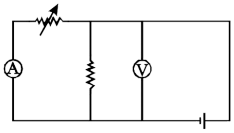
20. Express which of the following set ups can be used to verify ohm's law?

(a)



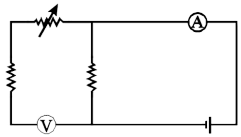
A.

(b)



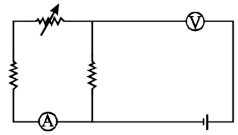
B.

(c)



C.

(d)



D.

Answer: A

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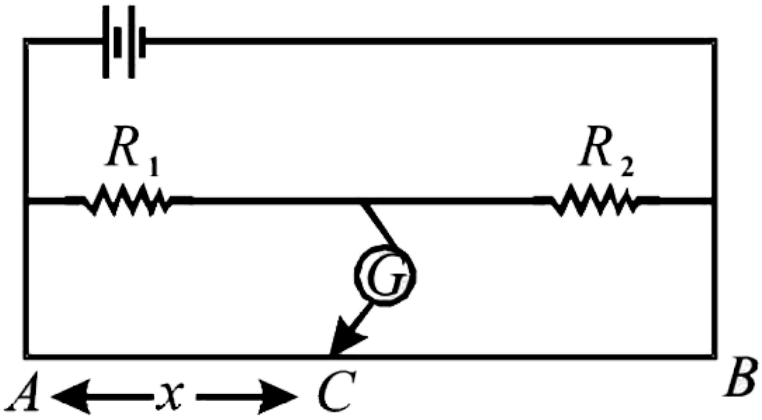
21. In the shown arrangement of the experiment of the meter bridge if AC corroesponding to null deflection of galvanometer is x, what would be its value if the radius of the wire AB is doubled?



A. x

B. $x/4$

C. 4x

D. 2x

Answer: A

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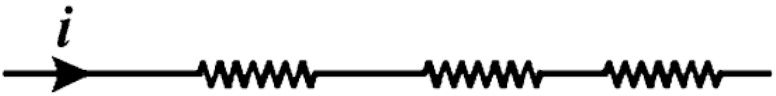
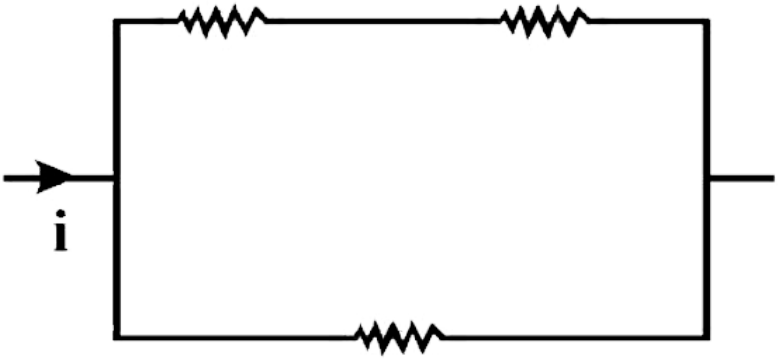
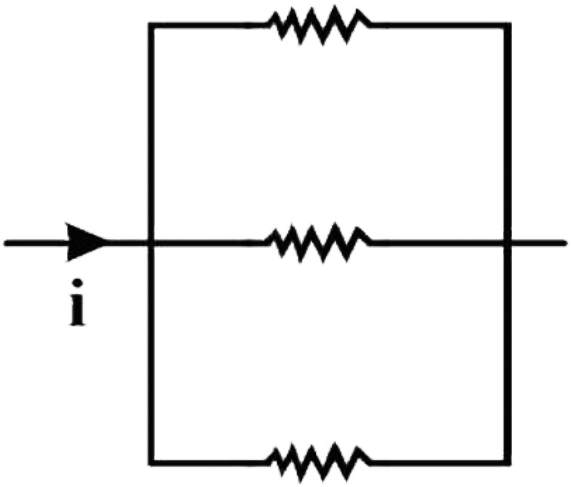
22. The three resistance of equal value are arranged in the different combination shown below. Arrange them in increasing order of power dissipation.



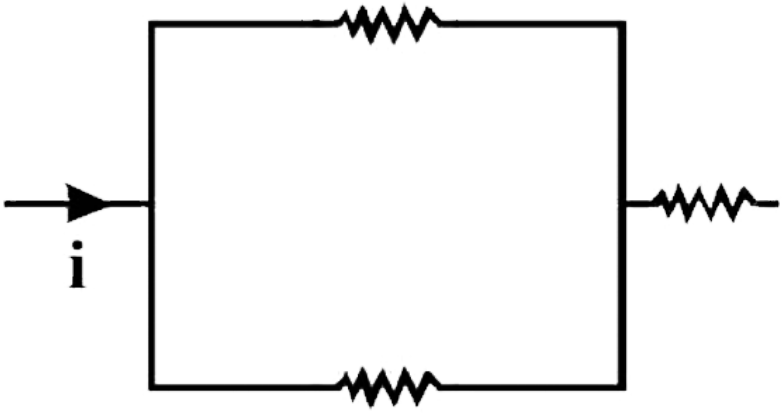
(I)

(II)





(IV)



A. $III < II < IV < I$

B. $II < III < IV < I$

C. $I < IV < III < II$

D. $I < III < II < IV$

Answer: A

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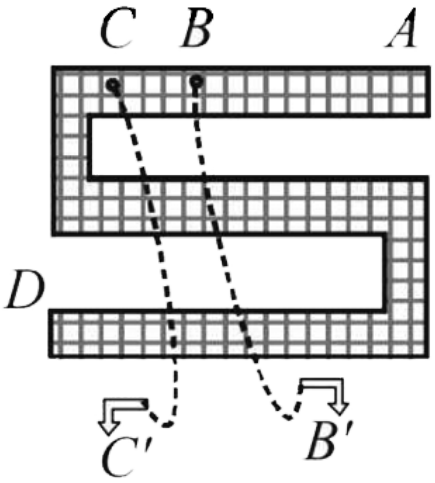
23. Shown in figure is a Post Office box. In order to calculate the value of external resistance, it should be connected between



A. B' and C

B. A and D

C. C and D

D. B and D

Answer: B

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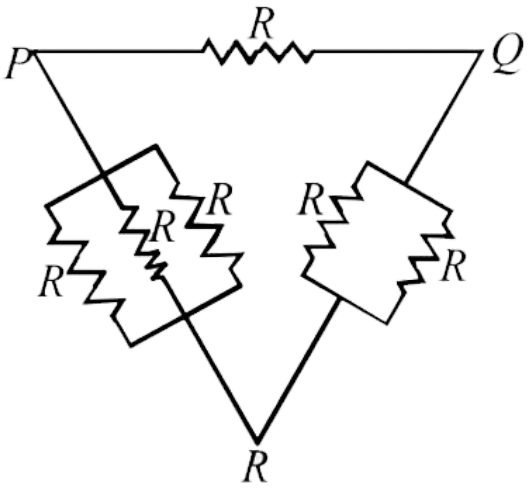
24. Six identical resistors are connected as shown in the figure. The equivalent resistance will be



A. Maximum between P and R

B. Maximum between Q and R

C. Maximum between P and Q

D. All are equal

Answer: C

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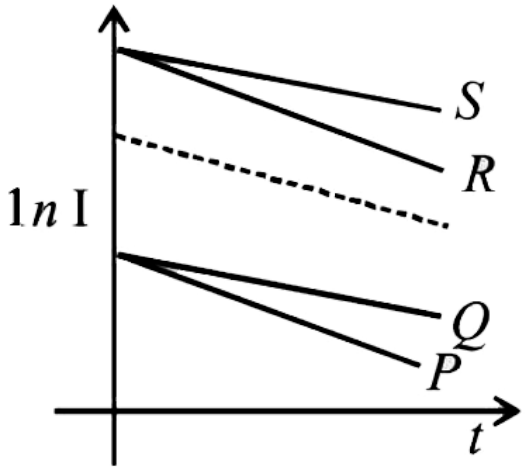
25. A capacitor is charged using an external battery with a resistance x in series. The dashed line showns the variation of In I with respect to time. If the resistance is changed to 2x, the new graph will be



A. P

B. Q

C. R

D. S

Answer: B

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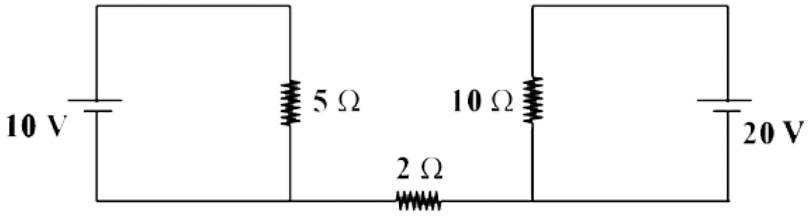
26. Find out the value of current through 2Ω resistance for the given circuit.



A. zero

B. $2A$

C. $5A$

D. $4A$

Answer: A

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27. A $4\mu F$ capacitor, a resistance of $2.5M\Omega$ is in series with $12V$ battery. Find the time after which the potential difference across the capacitor is 3 times the potential difference across the resistor. [Given In (2) = 0.693]

A. 13.86s

B. 6.93s

C. 7s

D. 14s

Answer: A

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28. A moving coil galvanometer of resistance 100Ω is used as an ammeter using a resistance 0.1Ω. The maximum diflection current in the galvanometer is $100\mu A$. Find the minimum current in the circuit so that the ammeter shows maximum deflection

A. 100.1 mA

B. 1000.1 mA

C. 10.01 mA

D. 1.01 mA

Answer: A

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29. An ideal gas is filled in a closed rigid and thermally insulated container. A coil of 100Ω resistor carrying current 1 A for 5 minutes supplies heat to the gas. The change in internal energy of the gas is

A. 10 kJ

B. 30 kJ

C. 20 kJ

D. 0 kJ

Answer: B

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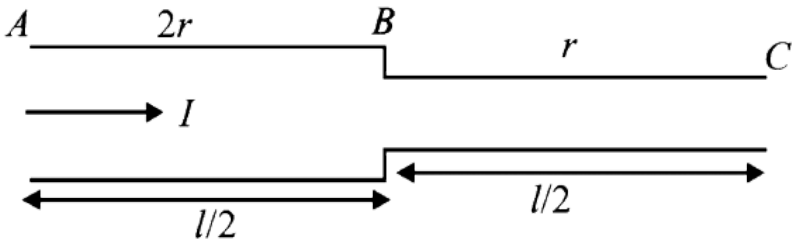
30. If a steady current I is flowing through a cylindrical element ABC. Choose the correct relationship



A. $V_{AB} = 2V_{BC}$

B. power across BC is 4 times the power across AB.

C. Current densities in AB and BC are equal.

D. Electric field due to current inside AB and BC are equal

Answer: B

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31. 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 points shifts by 20 cm. Neglecting any corrections, the unknown resistance is

A. 3Ω

B. 4Ω

C. 5Ω

D. 6Ω

Answer: A

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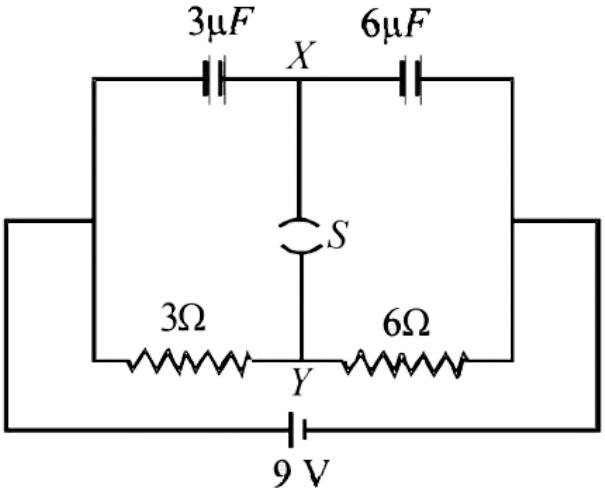
32. A circuit is connected as shown in the figure with the switch S open. When the switch is closed, the total amount of charge that flows from Y to X is



A. 0

B. $54\mu C$

C. $27\mu C$

D. $81\mu C$

Answer: C

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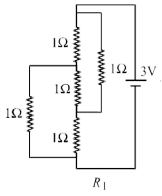
33. Figure shows three resistor configurations R_1, R_2 and R_3 connected to 3V battery. If the power dissipated by the configuration R_1, R_2 and R_3 is P_1, P_2 and P_3, respectively. Then -



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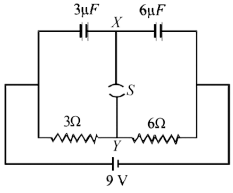

,

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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34. Incandescent bulbs are designed by keeping in mind that the resistance of their filament increases with the increase in temperature. If at room temperature, $100W, 60W$ and $40W$ bulbs have filament resistances R_{100}, R_{60} and R_{40}, respectively, the relation between these resistances is

A. $\frac{1}{R_{100}} = \frac{1}{R_{40}} + \frac{1}{R_{60}}$

B. $R_{100} = R_{40} + R_{60}$

C. $R_{100} > R_{60} > R_{40}$

D. $\frac{1}{R_{100}} > \frac{1}{R_{60}} > \frac{1}{R_{40}}$

Answer: D

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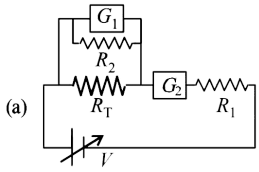
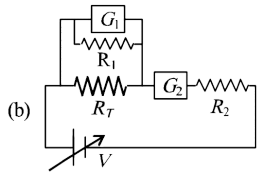
35. To verify Ohm's law, a student is provided with a test resistor R_T, a high resistance R_1, a small resistance R_2, two identical galvanometer G_1 and G_2, and a variable voltage source V. The correct circuit to carry out the experiment is

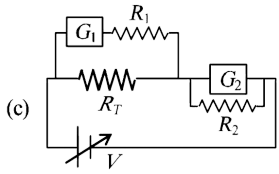
A.



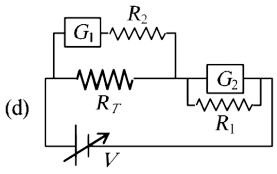
B.



C.



D.



Answer: C

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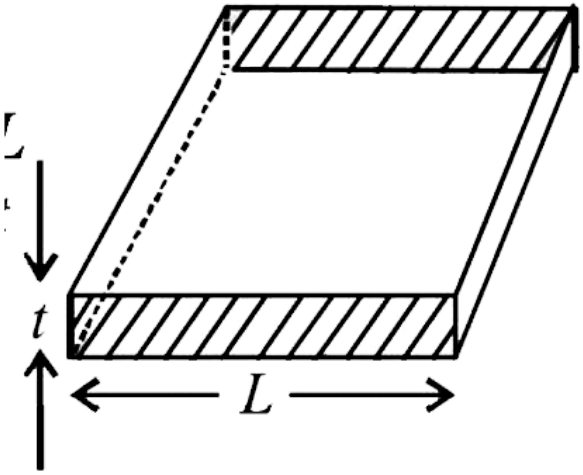
36. Consider a thin square sheet of side L and thickness t, made of a material of resistivity ρ. The resistance between two opposite faces, shown by the shaded areas in the figure is



A. directly proportional to L

B. directly proportional to t

C. independent of L

D. independent of t

Answer: C

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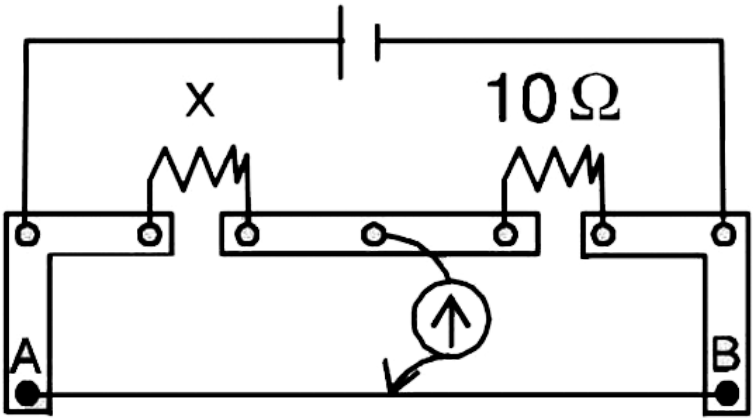
37. A meter bridge is set up as shown, to determine an unknown resistance X using a standard 10 ohm resistor. The galvanometer shows null point when tapping -key is at 52 cm mark. The end-corrections are 1 cm and 2 cm respectively for the ends A and B. The determine value of X is



A. 10.2 ohm

B. 10.6 ohm

C. 10.8 ohm

D. 11.1 ohm

Answer: B

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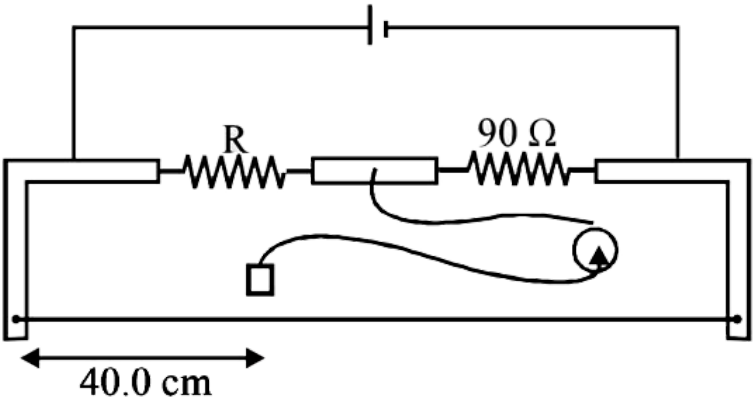
38. During an experiment with a metre bridge, the galvanometer shows a null point when the jockey is pressed at $40.0cm$ using a standard resistance of 90Ω, as shown in the figure. The least count of the scale used in the metre bridge is 1mm. The unknown resistance is



A. $60 \pm 0.15\Omega$

B. $135 \pm 0.56\Omega$

C. $60 \pm 0.25\Omega$

D. $135 \pm 0.23\Omega$

Answer: C

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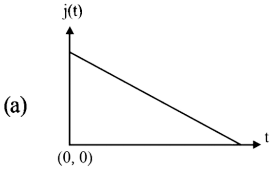
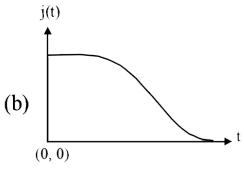
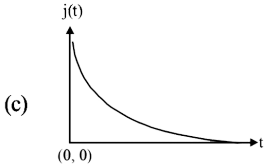
39. An infinite line charge of uniform electric charge density λ lies along the axis of an electrically conducting infinite cylindrical shell of radius R. At time $t = 0$, the space inside the cylinder is filled with a material of permittivity ε and electrical conductivity σ. The electrical conduction in the material follows Ohm's law. Which one of the following graphs best describes the subsequent variation of the magnitude of current density j(t) at any point in the material ?

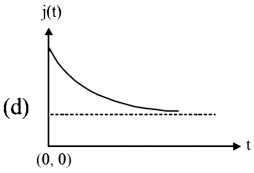
A.



B.



C. 

D. 

Answer: C

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40. Capacitor C_1 of capacitance 1 micro-farad and capacitor C_2 of capacitance 2 microfarad are separately charged fully by a common battery. The two capacitors are then separately allowed to discharged through equal resistors at time t = 0.

A. The current in each of the two discharging circuits is zero at t=0.

B. The currents in the two discharging circuits at t=0 are equal but not zero.

C. The currents in the two discharging circuits at t=0 are unequal.

D. Capacitors C_1, losses 50% of its initial charge sooner than C_2 loses 50% of its initial charge.

Answer: B::D

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41. Read the following statements carefully :

Y : The resistivity of a semiconductor decreases with increase of temperature.

Z : In a conducing solid, the rate of collisions between free electrons and ions increase with increase of temperature.

Select the correct statement (s) from the followin :

A. Y is true but Z is false

B. Y is false but Z is true.

C. Both Y and Z are true

D.

Answer: C

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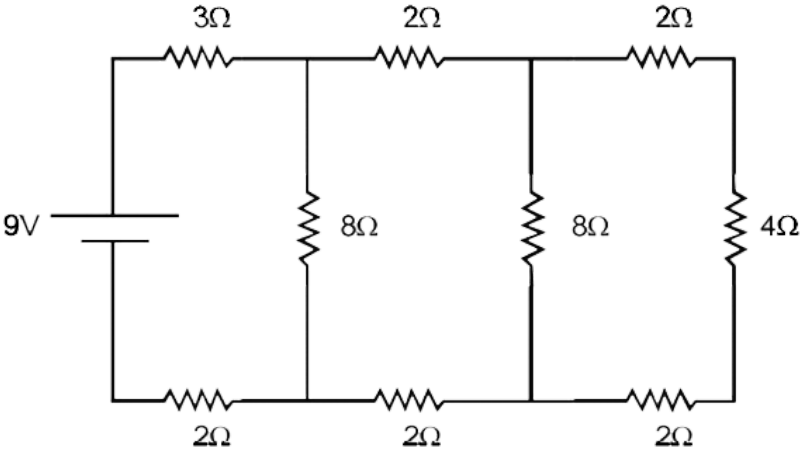
42. In the circuit shown in figure the current through



A. the 3Ω resistor is 0.50 A.

B. the 3Ω resistor is 0.25A

C. the 4Ω is 0.50A

D. the 4Ω resistor is 0.25A.

Answer: D

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43. When a potential difference is applied across, the current passing through

A. an insulator at 0 K is zero

B. a semiconductor at 0 K is zero

C. a metal at 0 K is finite

D. a p-n diode at 300K is finite, if it is reverse biased

Answer: A::B::D

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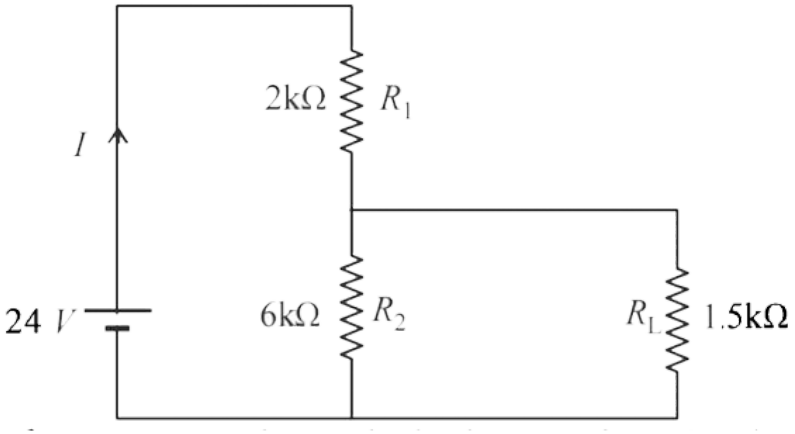
44. For the circuit shown in figure



A. the current I through the batter is 7.5 mA.

B. the potential difference across R_L is 18V.

C. ratio of powers dissipated in R_1 and R_2 is 3

D. if R_1 and R_2 are interchanged, magnitude of the power dissipated in R_L will decrease by a factor of 9.

Answer: A::D

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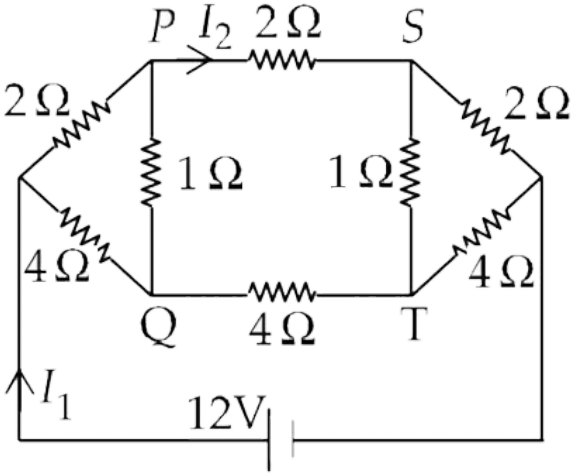
45. For the resistance network shown in the figure, choose the correct options (s)



A. The current through PQ is zero.

B. $I_1 = 3A$

C. The potential at S is less than that at Q.

D. $I_2 = 2A$

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

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46. Heater of an electric kettle is made of a wire of length L and diameter d. It takes 4 minutes to raise the temperature of 0.5 kg water by 40K. This heater is replaced by a new heater having two wires of the same material, each of length L and diameter 2d. The way these wires are connected is given in the options. How much time in minutes will it take to raise the temperature of the same amount of water by 40 K?

A. 4 if wires are in parallel

B. 2 if wires are in series

C. 1 if wires are in series

D. 0.5 if wires are in parallel

Answer: B::D

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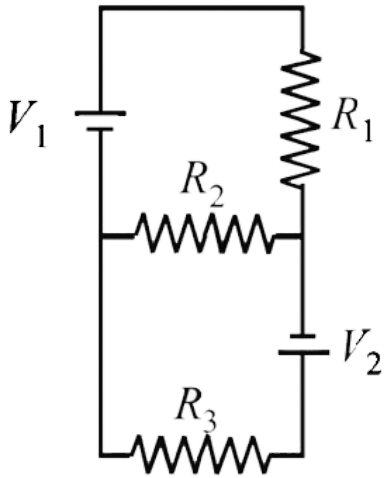
47. Two ideal batteries of emf V_1 and V_2 and three resistances R_1, R_2 and R_3 are connected as shown in the figure. The current in

resistance R_2 would be zero if



A. $V_1 = V_2$ and $R_1 = R_2 = R_3$

B. $V_1 = V_2$ and $R_1 = 2R_2 = R_3$

C. $V_1 = 2V_2$ and $2R_1 = 2R_2 = R_3$

D. $2V_1 = V_2$ and $3R_1 = R_2 = R_3$

Answer: A::B::D

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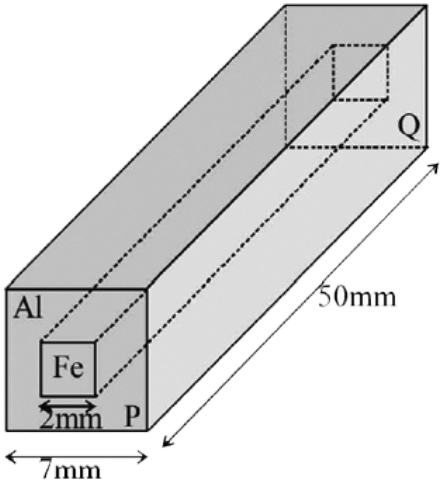
48. In an aluminium (Al) bar of square cross section, a square hole is drilled and is filled with iron (Fe) as shown in the figure. The electrical resistivities of Al and Fe are $2.7 \times \left(10^{-8}\right)\Omega m$ and $1.0 \times \left(10^{-7}\right)\Omega m$, respectively. The electrical resistance between the two faces P and Q of the composite bar is



A. $\frac{2475}{64}\mu\Omega$

B. $\frac{1875}{64}\mu\Omega$

C. $\frac{1875}{49}\mu\Omega$

D. $\frac{2475}{132}\mu\Omega$

Answer: B

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49. An incandescent bulb has a thin filament of tungsten that is heated to high temperature by passing an electric current. The hot filament emits black - body radiation. The filament is observed to break up at random to break up at random locations after a sufficiently long time of operation due to non-uniform evaporation of tungsten from the fialment. If the bulb is powered at constant voltage, which of the following statement (s) is (are) true?

A. The temperature distribution over the filament is uniform

B. The resistance over small sections of the filament decreases with time

C. The filament emits more light at higher band of frequencies before it breaks up

D. The filament consumers less electrical power towards the end of the life of the bulb.

Answer: C::D

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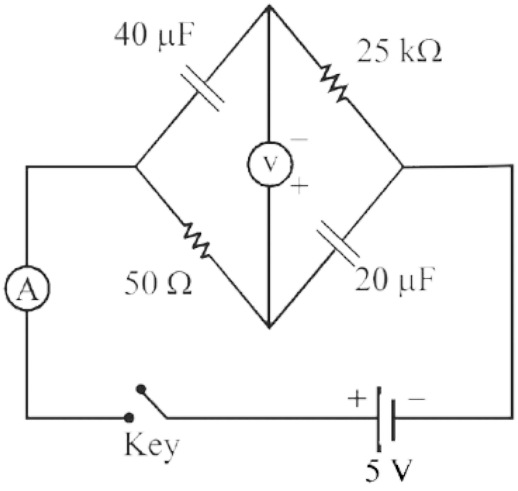
50. In the circuit shown below, the key is pressed at time t = 0 . Which of the following statements (s) is (are) true?



A. The voltmeter displays $(-5V)ass\infty nasthekeyispressed,$ and $displays$(+5 V)` after a long time

B. The volmeter will display 0V at time t = In 2 seconds.

C. The current in the ammeter becomes 1//e of the initial value after 1 second

D. The current in the ammeter becomes zero after a long time.

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

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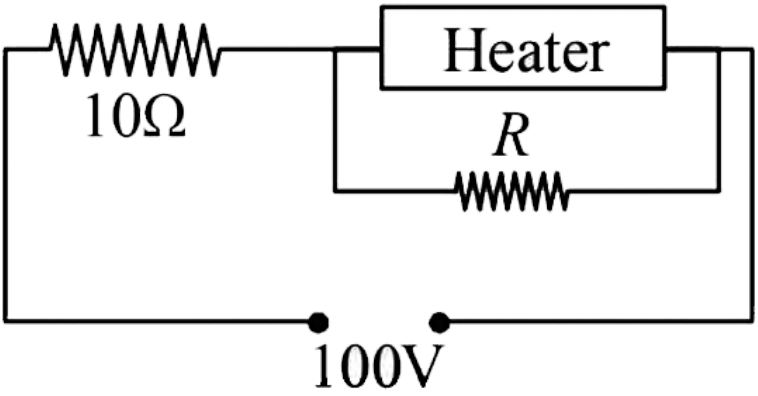
51. A heater is designed to operate with a power of 1000 walts in a 100 volt line. It is connected in a combinations with a resistance of 10 ohms and a resistance R to a 100 volts mains as shown in figure. What should be the value of R so that the heater operates with a power of 62.5 watts.



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52. If a copper wire is stretched to make it 0.1% longer wha is the percentage change in its resistance?

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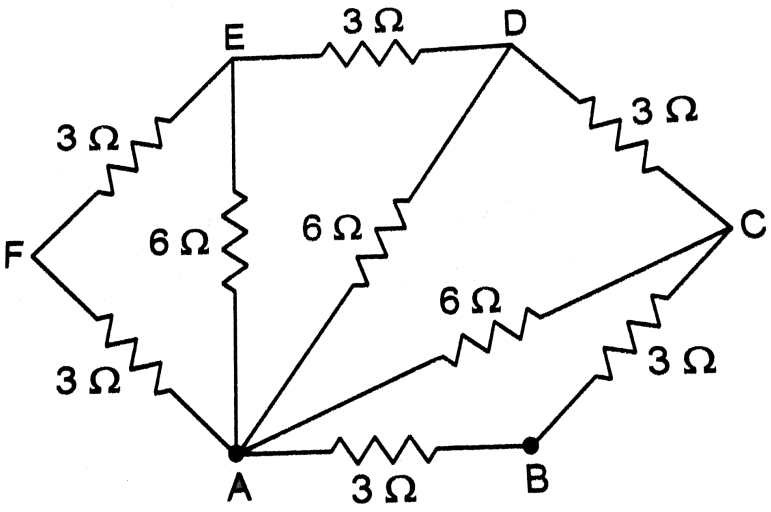
53. Find the equivalent resistance of the network shown in figure between the points a and b when (a) the switch S is open and (b) the switch S is closed .



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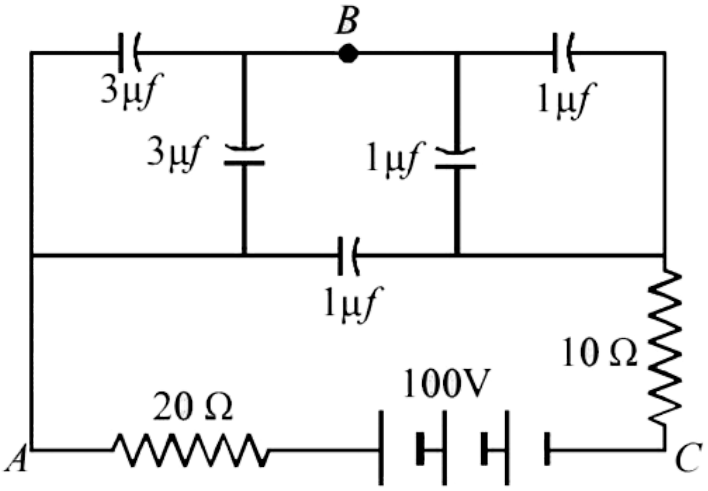
54. In the diagram shown find the potential difference between the points A and B and between the points B and C in the steady state.



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55. A battery of emf 2 volts and internal resistance 0.1 ohm is being charged with a current of 5 amps.

In what directions will the currents flow inside the battery? What is the potential difference between the two terminal of the battery?

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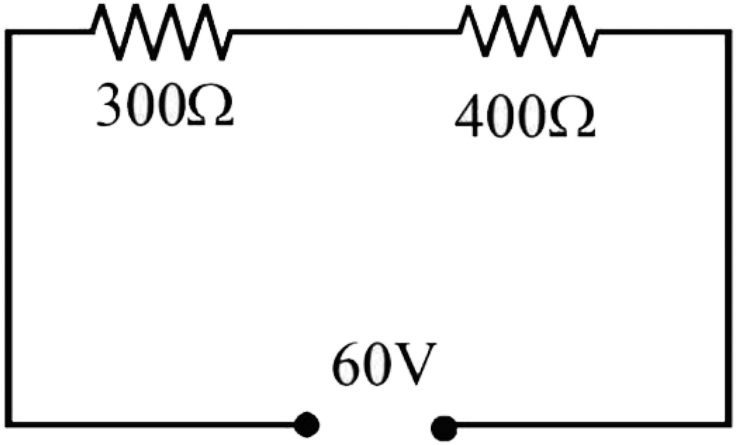
56. State ohm's law.

In the circuit shown in figure, a voltmeter reads 30 volts when it is connected across 400 ohm resistance. Calculate what the same voltmeter will read when it is connected across the 300 ohm resistance.



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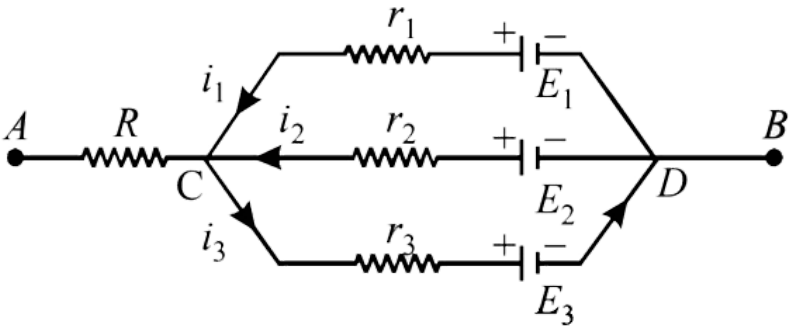
57. In the circuit shown in fig

$E_1 = 3vo < s, E_2 = 2vo < s, E_3 = 1vo <$ and $R = r_1 = r_2 = r_3 = 1ohr$



(i) Find the potential difference between the points A and B and the currents through each branch.

(ii) If r_2 is short circuited and the point A is connected to point B, find the current through E_1, E_2, E_3 and the resistor R.

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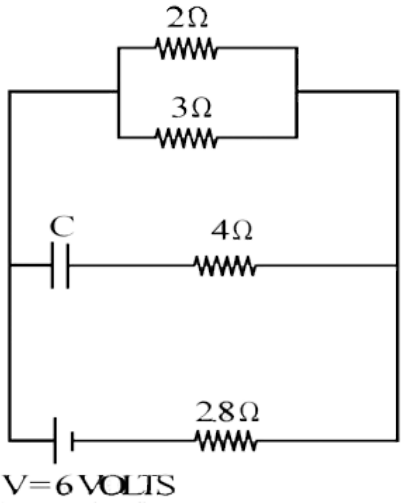
58. Calculate the steady state current in the 2- ohm resistor shown in the circuit in the figure. The intermal resistance of the battery is negligible

and the capacitance of the condenser C is 0.2 microfarad.



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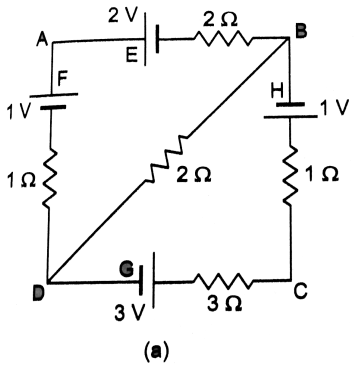
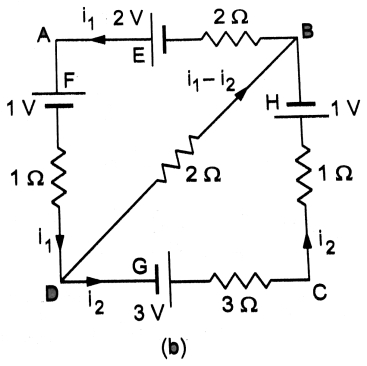
59. In the circuit shown in figure E,F, G and H are cell of emf 2,1,3, and $1V$ respectively. The resistances 2,1,3 and 1(Omega)are their respective internal resistance .Calculate (a)the potential difference between B and D and (b) the potential differences across the terminals of each of each of

the cells G and H.



(a)



(b)

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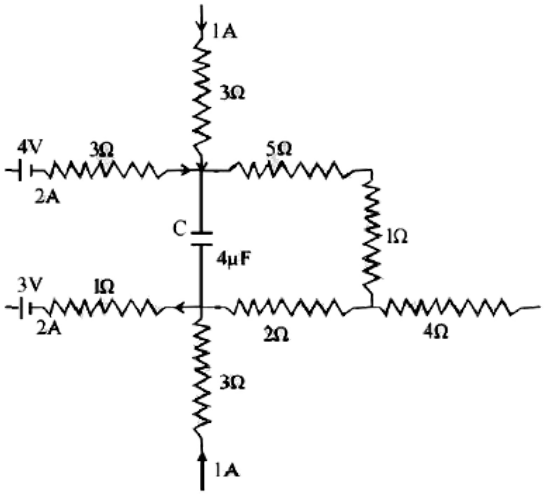
60. A part of circuit in a steady state along with the currents flowing in the branches, the values of resistance etc., is shown in the figure. Calculate the energy stored in the capacitor C (4muF)`



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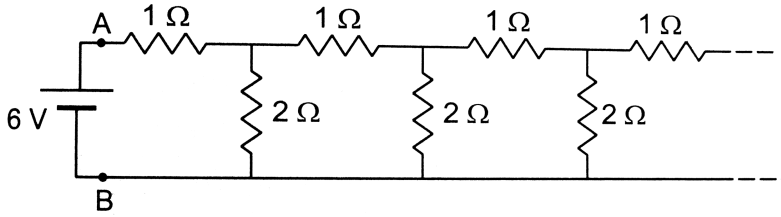
61. An infinite ladder is constructed with $1(\Omega)$and $2(\Omega)$resistor as shown in figure.(a)Find the effective resistance between the point A and B. (b) Find the current that passes through the (2Ω) resistor nearest to the battery.



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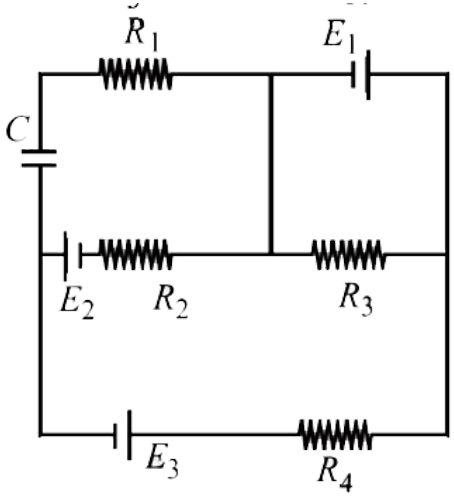
62. In the given circuit

$E_1 = 3E_2 = 2E_3 = 6vo < sR_1 = 2R_4 = 6ohms$

$R_3 = 2R_2 = 4ohmsC = 5\mu f.$

Find the current in R and the energy stored in the capacitor.



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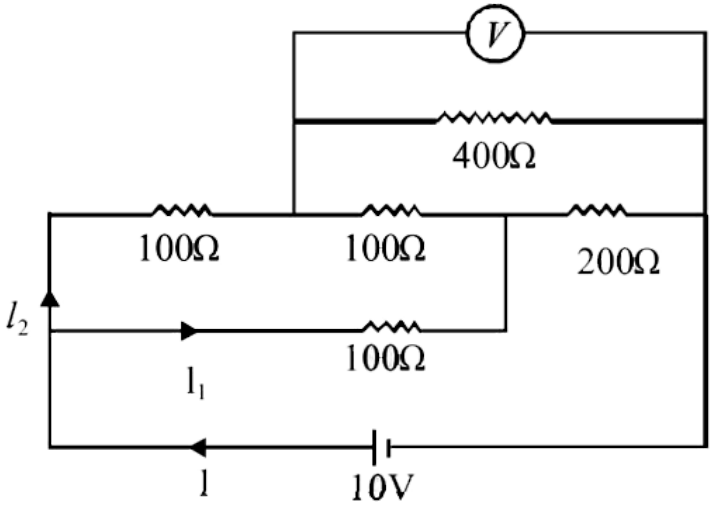
63. An elctrical circuit is shown in Fig. Calculate the potential difference across the resistor of 400 ohm, as will be measured by the voltmeter V of

resistance 400 ohm, either by applying Kirchhoff's rules or otherwise.



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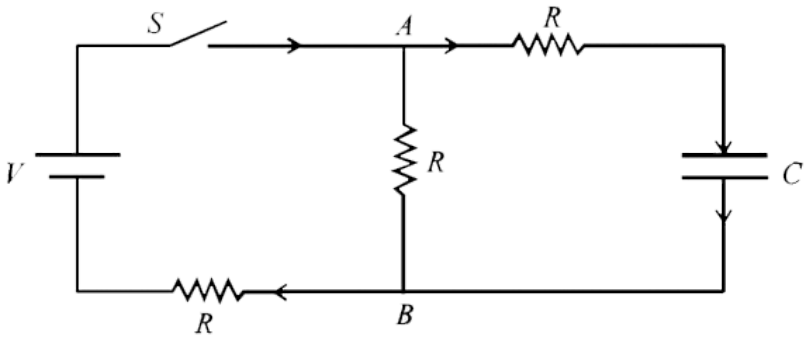
64. In the circuit shown in Figure, the battery is an ideal one, with emf V. The capacitor is initially uncharged. The switch S is closed at time t = 0 .

(a) Find the charge Q on the capacitor at time t.

(b) Find the current in AB at time t. What is its liniting value as $t \to \infty$:



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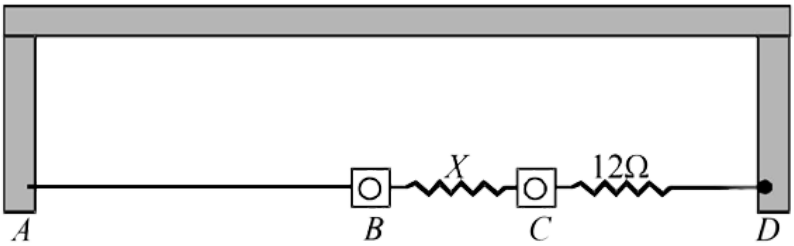
65. A thin uniform wire Ab of length 1m, an unknown resistance X and a resistance of 12Ω are connected by thick conducting strips, as shown in the figure. A battery and a galvanometer (with a sliding jockey connected to it) are also available. Connections are to be made to measure the unknown resistance X using the principle of Wheatstone bridge. Answer the following questions.



(a) Are there positive and negative terminals on the galvanometer?

(b) Copy the figure in your answer book and show the battery and the galvanometer (with jockey) connected at appropriate points.

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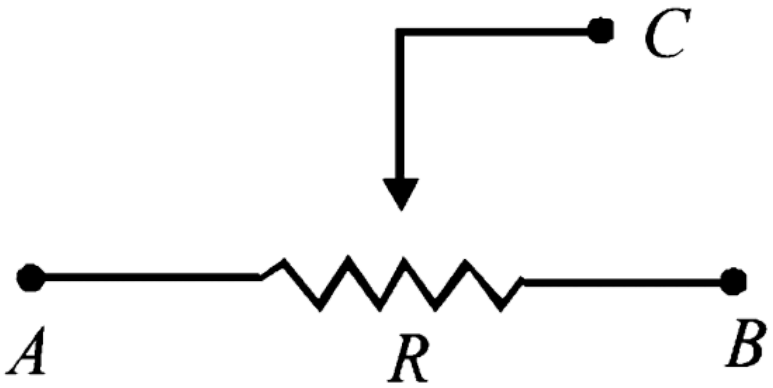
66. How a battery is to be connected so that the shown rheostat will behave like a potential divider? Also indicate the points about which

output can be taken.



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67. Draw the circuit diagram to verify Ohm's Law with the help of a main resistance of 100Ω and tow galvanometer of resistance $10^{6}\Omega$ and $10^{-3}\Omega$ and a source of varying emf.

Show the correct positions of volmeter and ammeter.

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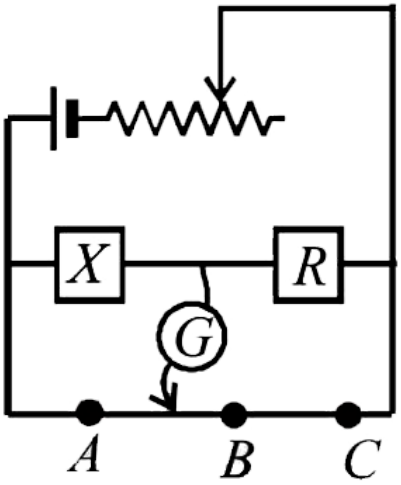
68. An unknown resistance X is to be determined using resistances R_1, R_2 or R_3. Their corresponding null points are A, B and C. Find which of the above will give the most accurate reading and why?



$R = R_1$ or R_2 or R_3.

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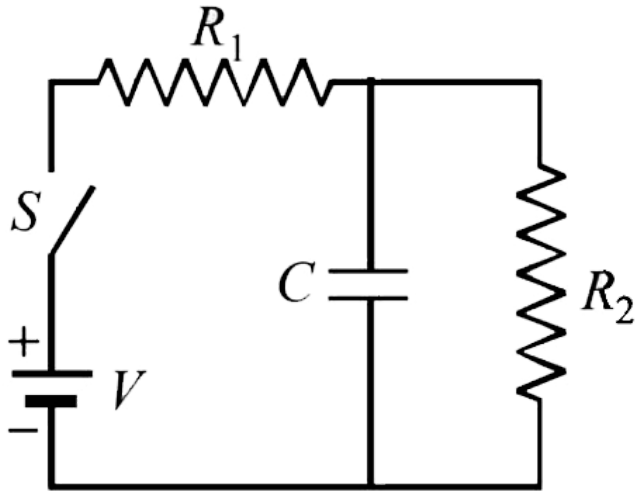
69. In the given circuit, the switch S is closed at time t = 0 . The charge Q on the capacitor at any instant t is given by $Q(t) = Q\left(1 - e^{-\alpha t}\right)$. Find the value of Q_0 and α in terms of given parameters as shown in the

circuit.



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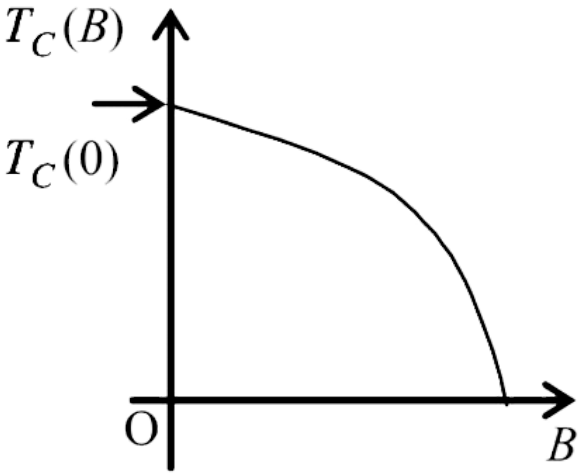
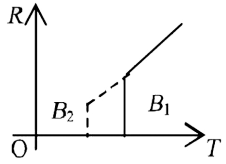
70. Electrical resistance of certain materials, known as superconductors, changes abruptly from a nonzero value of zero as their temperature is lowered below a critical temperature $T_C(0)$. An interesting property of super conductors is that their critical temperature becomes smaller than $T_C(0)$ if they are placed in a magnetic field, i.e., the critical temperature $T_C(B)$ is a function of the magnetic field strength B. The dependence of $T_C(B)$ on B is shown in the figure.

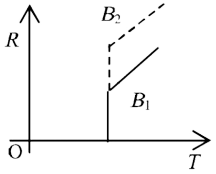


In the graphs below, the resistance R of a superconductor is shown as a function of its temperature T for two different magnetic fields B_1(solid line) and B_2 (dashed line). If B_2 is larget than B_1 which of the following graphs shows the correct variation of R with T in these fields?

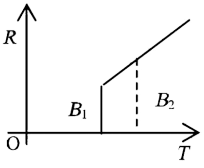
A.



B.

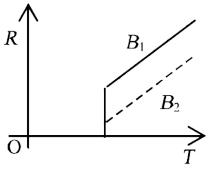


C.



D.

(d)



Answer: A

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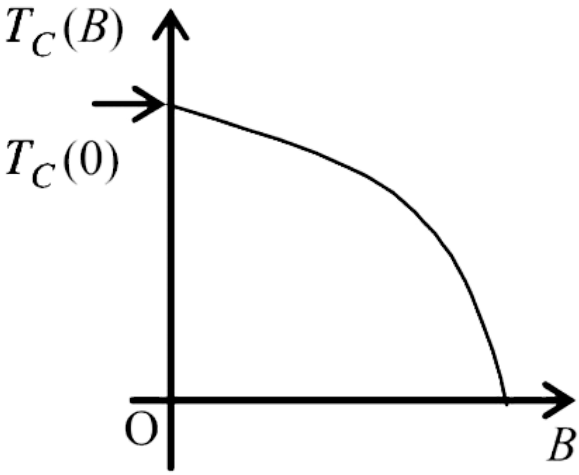
71. Electrical resistance of certain materials, known as superconductors, changes abruptly from a nonzero value of zero as their temperature is lowered below a critical temperature $T_C(0)$. An interesting property of super conductors is that their critical temperature becomes smaller than $T_C(0)$ if they are placed in a magnetic field, i.e., the critical temperature $T_C(B)$ is a function of the magnetic field strength B. The dependence of $T_C(B)$ on B is shown in the figure.



A superconductor has $T_C(0) = 100K$. When a magnetic field of 7.5 Tesla is applied , its T_C decreases to 75 K. For this material one can difinitely say that when

A. $B = 5Tesla, T_C(B) = 80K$

B. $B = 5Tesla, 75K < T_C(B) < 100K$

C. $B = 10Tesla, 75 < T_C(B) < 100K$

D. $B = 10Tesla, T_C(B) = 70K.$

Answer: B

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72. Statement-1 : In a Meter Bridge experiment, null point for an unknown resistance is measured. Now, the unknown resistance is put inside an enclosure maintained at a higher temperature. The null point can be obtained at the same point as before by decreasing the value of the standard resistance.

Statement-2 : Resistance of metal increases with increase in temperature.

A. Statement-1 is true, Statement-2 is True, Statement-2 is a correct explanation for Statement-1

B. Statement -1 is True, Statement-2 is True, Statement -2 is NOT a correct explanation for Statement-1.

C. Statement-1 is True, Statement-2 is False.

D. Statement-1 is False, Statement-2 is True.

Answer: D

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73. When two identical batteries of internal resistance 1Ω each are connected in series across a resistor R, the rate of heat produced in R is J_1. When the same batteries are connected in parallel across R, the rate is J_2 = 2.25 J_2$then the value of R \in$ Omega` is

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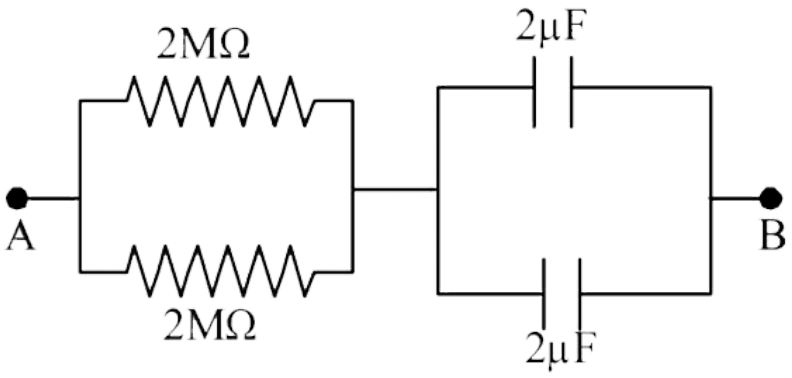
74. At time t=0, a battery of 10 V is connected across points A and B in the given circuit. If the capacitors have no charge initially, at what time (in seconds) does the voltage across them beocme 4V? $[Take: In5 = 1.6, In3 = 1.1]$.



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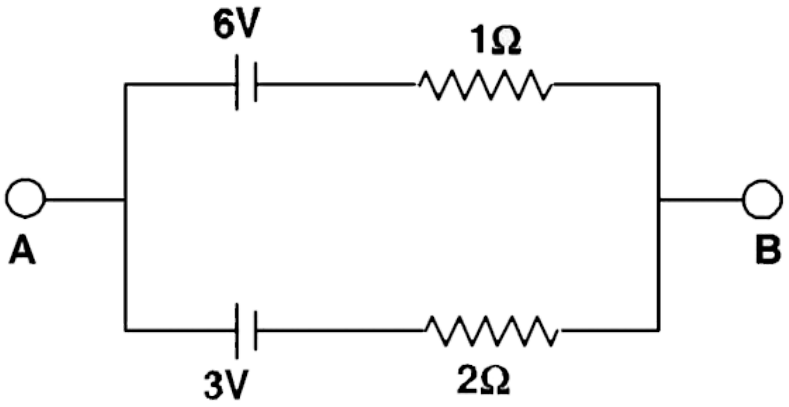
75. Two batteries of different emfs and different internal resistances are connected as shown. The voltage across AB in volts is.



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76. A galvanometer gives full scale deflection with 0.006 A current. By connecting in to a 4990Ω resistance, it can be converted into a voltmeter of range 0-30V. If connected to a $\frac{2n}{249}\Omega$ resistance, it becomes an ammeter of range $0-1.5A$. The value of n is

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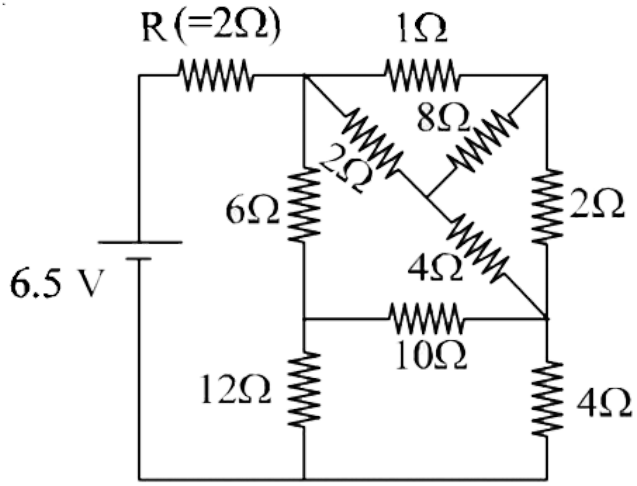
77. In the following circuit, the current through the resistor $R(=2\Omega)$ is I amperes. The value of I is



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78. If an ammeter is to be used in place of a voltmeter, then we must connect with the ammeter a

A. low resistance in parallel

B. high resistance in parallel

C. high resistance in series

D. low resistance in series.

Answer: C

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79. A wire when connected to 220 V mains supply has power dissipation P_1. Now the wire is cut into two equal pieces which are connected in parallel to the same supply. Power dissipation in this case is P_2. Then $P_2 : P_1$ is

A. 1

B. 4

C. 2

D. 3

Answer: B

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80. If a current is passed through a spring then the spring will

A. expand

B. compress

C. remains same

D. None of these

Answer: B

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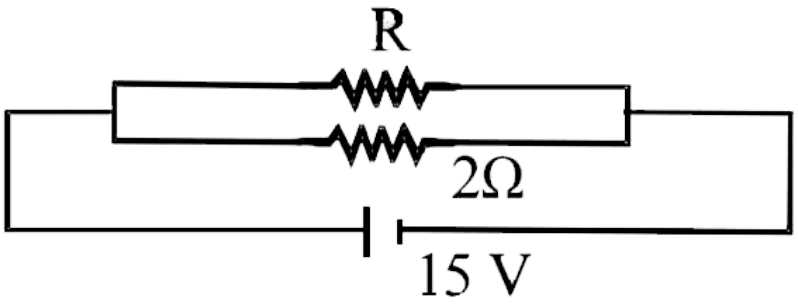
81. If in the circuit, power dissipation is 150W, the R is



A. 2Ω

B. 6Ω

C. 5Ω

D. 4Ω

Answer: B

Watch Video Solution

82. The mass of product liberated on anode in an electrochemical cell depends on

(where t is the time period for which the current is passed.)

A. $(It)^{\frac{1}{2}}$

B. It

C. I/t

D. I^2t

Answer: B

Watch Video Solution

83. If θ_i, is the inversion temperature, θ_n is the neutral temperature, θ_c is the temperature of the cold junction, then

A. $\theta_i + \theta_c = \theta_n$

B. $\theta_i - \theta_c = 2\theta_n$

C. $\frac{\theta_i + \theta_c}{2} = \theta_n$

D. $\theta_c - \theta_i = 2\theta_n$

Answer: C

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84. The length of a wire of a potentiometer is 100 cm, and the e.m.f. of its standard cell is E volt. It is employed to measure the e.m.f. of a battery whose internal resistance is 0.5Ω. If the balance point is obtained at I = 30 cm from the positive end, the e.m.f. of the battery is .

where i is the current in the potentiometer wire.

A. $\frac{30E}{100.5}$

B. $\frac{30E}{100 - 0.5}$

C. $\frac{30(E - 0.5i)}{100}$

D. $\frac{30E}{100}$

Answer: D

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85. The thermo e.m.f. of a thermo- couple is $25\mu V/^{\circ}C$ at room temperature. A galvanometer of 40 ohm resistance, capable of detecting current as low as 10^{-5}A, is connected with the thermo couple. The smallest temperature difference that can be detected by this system is

A. $16^{\circ}C$

B. $12^{\circ}C$

C. $8^{\circ}C$

D. $20^{\circ}C$

Answer: A

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86. The negative Zn pole of a Daniell cell, sending a constant current through a circuit, decreases in mass by 0.13 g in 30 minutes. If the

electeochemical equivalent of Zn and Cu are 32.5 and 31.5 respectively, the increase in the mass of the positive. Cu pole in this time is

A. 0.180g

B. 0.141 g

C. 0.126 g

D. 0.242 g

Answer: C

Watch Video Solution

87. An ammeter reads upto 1 ampere. Its internal resistance is 0.81 ohm. To increase the range to 10 A the value of the required shunt is

A. 0.03Ω

B. 0.3Ω

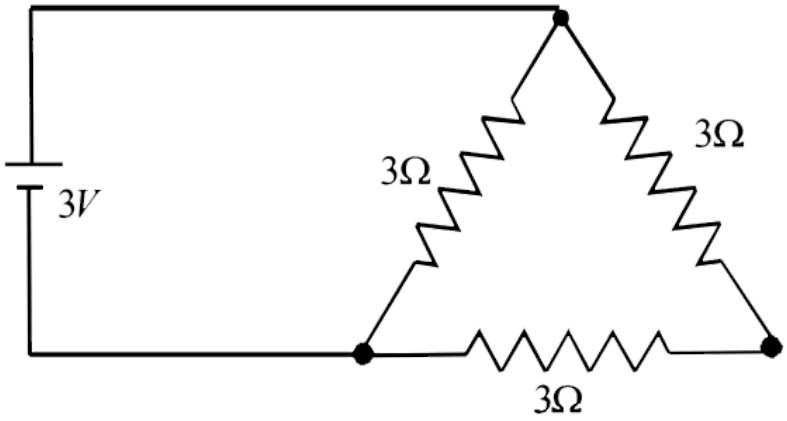
C. 0.9Ω

D. 0.09Ω

Answer: D

Watch Video Solution

88. A 3 volt battery with negligible internal resistance is connected in a circuit as shown in the figure. The current I, in the circuit will be



A. $1A$

B. 1.5A

C. $2A$

D. $1/3A$

Answer: B

Watch Video Solution

89. A 220 volt, 1000 watt bulb is connected across a 110 volt mains supply. The power consumed will be

A. 750 watt

B. 500 watt

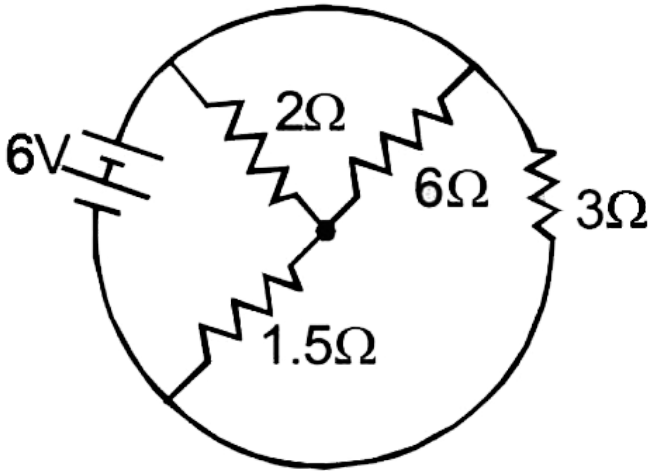
C. 250 watt

D. 1000 watt

Answer: C

Watch Video Solution

90. The total current supplied to the circuit by the battery is



A. $4A$

B. $2A$

C. $1A$

D. $6A$

Answer: A

Watch Video Solution

91. 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. 2

B. 3

C. 4

D. 1

Answer: C

Watch Video Solution

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

A. $8/9$

B. $1/3$

C. 3

D. 2

Answer: B

Watch Video Solution

93. In a meter bridge experiment null point is obtained at 20 cm. from one end of the wire when resistance X is balanced against another resistance Y. If XltY, then where will be the new position of the null point from the same end, if one deicdes to balance a resistance of 4 X against Y

A. 40 cm

B. 80 cm

C. 50 cm

D. 70 cm

Answer: C

Watch Video Solution

94. The termistors are usually made of

A. metal oxides with high temperature coefficient of resistivity

B. metals with high temperature coefficient of resistivity

C. metals with low temperature coefficient of resistivity

D. semiconducting materials having low temperature coefficient of resistivity

Answer: A

Watch Video Solution

95. Time taken by a 836 W heater to heat one litre of water from $10^\circ C \rightarrow 40^\circ C$ is

A. 150 s

B. 100 s

C. 50 s

D. 200 s

Answer: A

Watch Video Solution

96. The thermo emf of thermocouple varies with the temperature $\theta of the hot junction as$E = atheta + btheta^2 $\in vo < swhere the ratio$a//b is700^@C. $If the cold junction is kept at$0^@C`, then the neutral temperature is

A. $1400^\circ C$

B. $350^\circ C$

C. $700^\circ C$

D. No neutral temperature is possible for this termocouple.

Answer: D

Watch Video Solution

97. The electrochemical equivalent of a metal is 3.35109^{-7} kg per Coulomb. The mass of the metal liberated at the cathode when a 3A current is passed for 2 seconds will be

A. $6.6 \times 10^{57} kg$

B. $9.9 \times 10^{-7} kg$

C. $19.8 \times 10^{-7} kg$

D. $1.1 \times 10^{-7} kg$

Answer: C

Watch Video Solution

98. Two thin, long, parallel wires, separated by a distance 'd' carry a current of 'i' A in the same direction. They will

A. repel each other with a force of $\mu_0 i^2 / (2\pi d)$

B. attract each other with a force of $\mu_0 i^2 / (2\pi d)$

C. repel each other with a force of $\mu_0 i^2 / \left(2\pi d^2\right)$

D. attract each other with a force of $\mu_0 i^2 / \left(2\pi d^2\right)$

Answer: B

Watch Video Solution

99. A heater coil is cut into two equal parts and only one part is now used in the heater. The heat generated will now be

A. four times

B. doubled

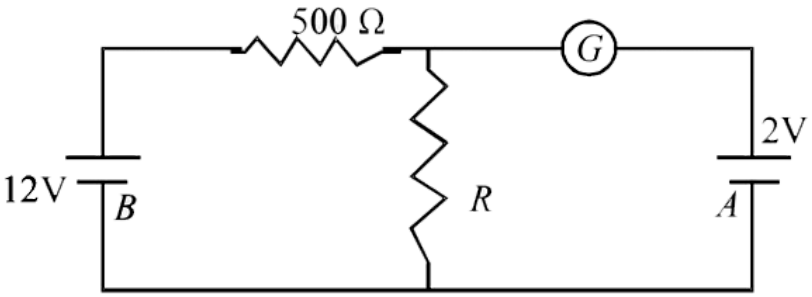
C. halved

D. one fourth

Answer: B

Watch Video Solution

100. In the circuit, the galvanometer G shows zero deflection. If the batteries A and b have negligible internal resistance, the value of the resistor R will be -



A. 100Ω

B. 200Ω

C. 1000Ω

D. 500Ω

Answer: A

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101. A moving coil galvanometer has 150 equal divisions. Its current sensitivity is 10-divisions per milliampere and voltage sensitivity is 2 divisions per millivolt. In order that each division reads 1 volt, the resistance in ohms needed to be connected in series with the coil will be -

A. 10^5

B. 10^3

C. 9995

D. 99995

Answer: C

Watch Video Solution

102. Two sources of equal emf are connected to an external resistance R. The internal resistance of the two sources are R_1 and $R_2(R_1 > R_1)$. if the potential difference across the source having internal resistance R_2 is zero, then

A. $R = R_2 - R_1$

B. $R = R_2 \times (R_1 + R_2)/(R_2 - R_1)$

C. $R = R_1 R_2/(R_2 - R_1)$

D. $R = R_1 R_2/(R_1 - R_2)$

Answer: A

Watch Video Solution

103. Two voltameters, one of copper and another of silver, are joined in parallel. When a total charge q flows through the voltameters, equal

amount of metals are deposited. If the electrochemical equivalents of copper and silver are Z_1 and Z_2 respectively the charge which flows through the silver voltameter is

A. $\frac{q}{1+\frac{Z_2}{Z_1}}$

B. $\frac{q}{1+\frac{Z_1}{Z_2}}$

C. $q\left(\frac{Z_2}{Z_1}\right)$

D. $q\left(\frac{Z_1}{Z_2}\right)$

Answer: A

Watch Video Solution

104. In a potentiometer experiment the balancing with a cell is at length 240 cm. On shunting the cell with a resistance of 2Ω, the balancing length becomes 120 cm.The internal resistance of the cell is

A. 0.5Ω

B. 1Ω

C. 2Ω

D. 4Ω

Answer: C

Watch Video Solution

105. The resistance of hot tungsten filament is about 10 times the cold resistance. What will be the resistance of 100 W and 200 V lamp when not in use?

A. 20Ω

B. 40Ω

C. 200Ω

D. 400Ω

Answer: B

Watch Video Solution

106. An energy source will supply a constant current into the load if its internal resistance is

A. very large as compared to the load resistance

B. equal to the resistance of the load

C. non-zero but less than the resistance of the load

D. zero

Answer: D

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107. The Kirchhoff's first law $(\Sigma i = 0)$ and second law $(\Sigma iR = \Sigma E)$, where the symbols have their usual meanings, are respectively based on

A. conservation of charge, conservation of momentum

B. conservation of energy, conservation of charge

C. conservation of momentum, conservation of charge

D. conservation of charge, conservation of energy.

Answer: D

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108. A material 'B' has twice the specific resistance of 'A'. A circular wire made of 'B' has twice the diameter of a wire made of 'A'. Then for the two wires to have the same resistance, the ratio l_B/l_A of their respective lengths must be

A. 1

B. $\frac{1}{2}$

C. $\frac{1}{4}$

D. 2

Answer: D

Watch Video Solution

109. A thermocouple is made from two metals, Antimony and Bismuth. If one junction of the couple is kept hot and the other is kept cold, then, an electric current will

A. flow from Antimony to Bismuth at the hot junction

B. flow from Bismuth to Antimony at the cold junction

C. now flow through the thermocouple

D. flow from Antimony to Bismuth at the cold junction

Answer: D

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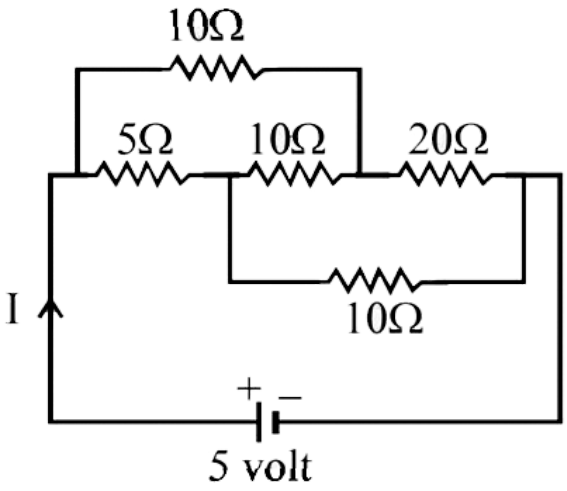
110. The current I drawn from the 5 volt source will be



A. 0.33A

B. 0.5A

C. 0.67A

D. 0.17A

Answer: B

Watch Video Solution

111. The resistance of a bulb filmanet is 100Ω at a temperature of $100^\circ C$. If its temperature coefficient of resistance be 0.005 per $\hat{}\ \circ C$, its resistance will become 200Ω at a temperature of

A. $300^\circ C$

B. $400^\circ C$

C. $500^\circ C$

D. $200^\circ C$

Answer: B

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112. In a Wheatstone's bridge, three resistances P,Q and R connected in the three arms and the fourth arm is formed by two resistances S_1 and S_2 connected in parallel. The condition for the bridge to be balanced will be

A. $\frac{P}{Q} = \frac{2R}{S_1 + S_2}$

B. $\frac{P}{Q} = \frac{R(S_1 + S_2)}{S_1 S_2}$

C. $\frac{P}{Q} = \frac{R(S_1 + S_2)}{2S_1 S_2}$

D. $\frac{P}{Q} = \frac{R}{S_1 + S - 2}$

Answer: B

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113. An electric bulb is rated 220 volt - 100 watt. The power consumed by it when operated on 110 volt will be

A. 75 watt

B. 40 watt

C. 25 watt

D. 50 watt

Answer: C

Watch Video Solution

114. A battery is used to charge a parallel plate capacitor till the potential differece between the plates becomes equal to the electromotive force of the battery. The ratio of the energy stored in the capacitor and the work done by the battery will be

A. $1/2$

B. 1

C. 2

D. $1/4$

Answer: A

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115. The resistance of a wire is 5 ohm at $50^\circ C$ and 6 ohm at $100^\circ C$. The resistance of the wire at $0^\circ C$ will be

A. 3 ohm

B. 2 ohm

C. 1 ohm

D. 4 ohm

Answer: D

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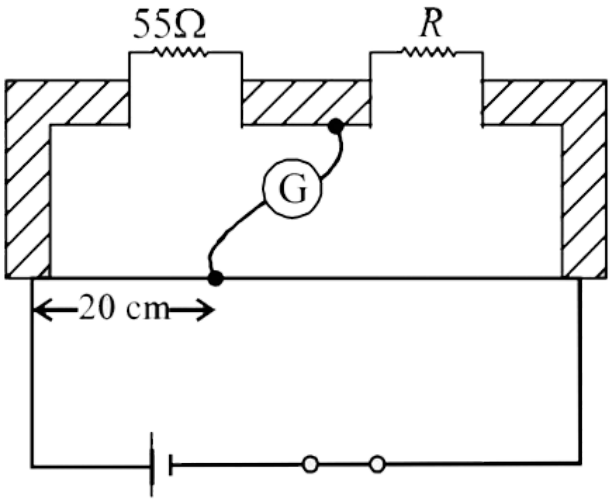
116. Shown in the figure below is a meter- bridge set up will null deflection in the galvanometer.



The value of the unknown resistor R is

A. 13.75Ω

B. 220Ω

C. 110Ω

D. 55Ω

Answer: B

Watch Video Solution

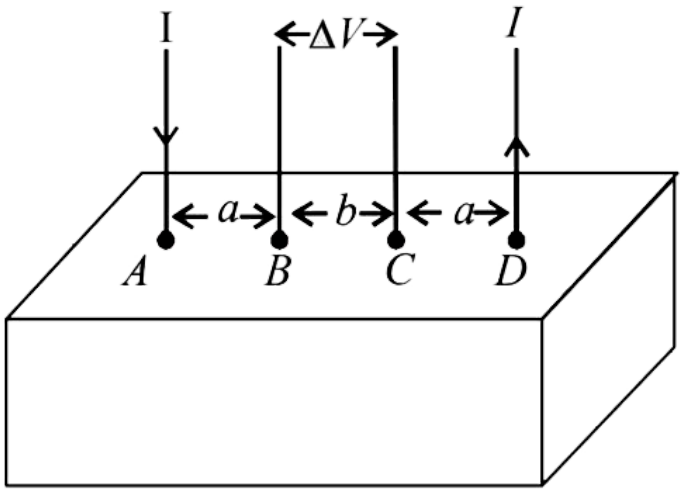
117. Consider a block of conducting material of resistivity $'\rho'$ shown in the figure. Current $'I'$ enters at 'A' and leaves from 'D'. We apply superposition principle to find voltage ΔV developed between 'B' and 'C'. The calculation is done in the following steps:

(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) and (iii) for current 'I' leaving 'D' and superpose results for 'A' and 'D'.



`Delta V measured between B and C is

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

B. $\frac{\rho I}{a} - \frac{\rho I}{a+b}$

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

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

Answer: A

Watch Video Solution

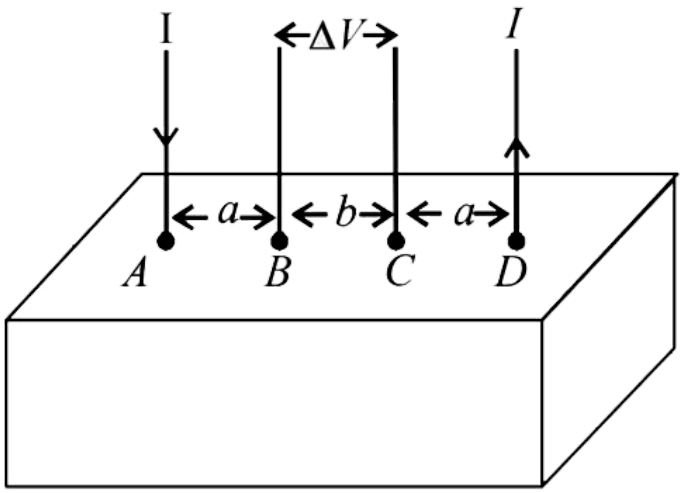
118. Consider a block of conducting material of resistivity $'\rho'$ shown in the figure. Current $'I'$ enters at 'A' and leaves from 'D'. We apply superposition principle to find voltage ΔV developed between 'B' and 'C'. The calculation is done in the following steps:

(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) and (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'

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

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

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

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

Answer: C

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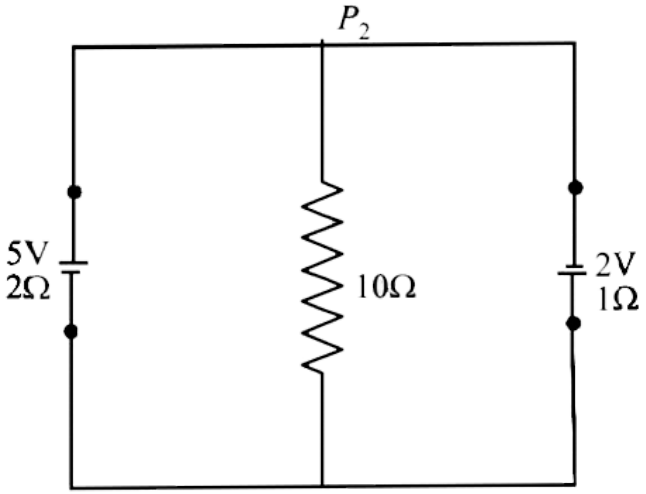
119. A 5V battery with internal resistance 2Ω and a 2V battery with internal resistance1Ω are connected to a 10Ω resistor as shown in the figure.



The current in the 10Ω resistor is

A. $0.27AP_2 \rightarrow P_1$

B. $0.03AP_1 \rightarrow P_2$

C. $0.03AP_2 \rightarrow P_1$

D. $0.27AP_1 \rightarrow P_2$

Answer: C

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120. LetC be the capacitance of a capacitor discharging through a resistor R. Suppose t_1 is the time taken for the energy stored in the capacitor to reduce to half its initial value and t_2 is the time taken for the charge to reduce to one-fourth its initial value. Then the ratio t_1/t_2 will be

A. 1

B. $1/2$

C. $1/4$

D. 2

Answer: C

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121. Two conductors have the same resistance at $0^\circ C$ but their temperature coefficient of resistanc are α_1 and α_2. The respective

temperature coefficients of their series and parallel combinations are nearly

A. $\frac{\alpha_1 + \alpha_2}{2}, \alpha_1 + \alpha_2$

B. $\alpha_1 + \alpha_2, \frac{\alpha_1 + \alpha_2}{2}$

C. $\alpha_1 + \alpha_2, \frac{\alpha_1 \alpha_2}{\alpha_1 + \alpha_2}$

D. $\frac{\alpha_1 + \alpha_2}{2}, \frac{\alpha_1 + \alpha_2}{2}$

Answer: D

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122. If a copper wire is stretched to make it $0.1\,\%$ longer wha is the percentage change in its resistance?

A. increase by $0.2\,\%$

B. decrease by $0.2\,\%$

C. decrease by $0.05\,\%$

D. increase by $0.05\ \%$

Answer: A

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123. Two electic bulbs marked $25W - 220V$ and $100W - 220V$ are connected in series to a 440 V supply. Which of the bulbs will fuse?

A. Both

B. 100 W

C. 25 W

D. Neither

Answer: C

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124. The supply voltage to room is 120 V. The resistance of the lead wires is 6Ω. A 60 W bulb is already switched on. What is the decrease of voltage across the bulb, when a 240 W heater is switched on in parallel to the bulb?

A. zero

B. 2.9 Volt

C. 13.3 Volt

D. 10.04 Volt

Answer: D

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125. This questions has Statement I and Statement II. Of the four choices given after the Statements, choose the one that best describes into two Statements.

Statement-I : Higher the range, greater is the resistance of ammeter.

Statement- II : To increase the range of ammeter, additional shunt needs to be used across it.

A. Statement-1 is true, Statement-2 is True, Statement-2 is a correct explanation for Statement-1

B. Statement -1 is True, Statement-2 is True, Statement -2 is NOT the correct explanation for Statement-1.

C. Statement-1 is True, Statement-2 is False.

D. Statement-1 is False, Statement-2 is True.

Answer: D

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126. In a large building, there are 15 bulbs of 40 W, 5 bulbs of 100 W, 5 fans of 80 W and 1 heater of 1 kW. The voltage of electric mains is 220 V. The minimum capacity fo the main fuse of the building will be :

A. $8A$

B. $10A$

C. $12A$

D. $14A$

Answer: C

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127. When 5 V potential difference is applied across a wire of length 0.1 m, the drift speed of electrons is $2.5 \times 10^{-4} ms^{-1}$. If the electron density in the wire is $8 \times 10^{28} m^{-3}$, the resistivity of the material is close to :

A. $1.6 \times 10^{-6} \Omega m$

B. $1.6 \times 10^{-5} \Omega m$

C. $1.6 \times 10^{-8} \Omega m$

D. $1.6 \times 10^{-7} \Omega m$

Answer: B

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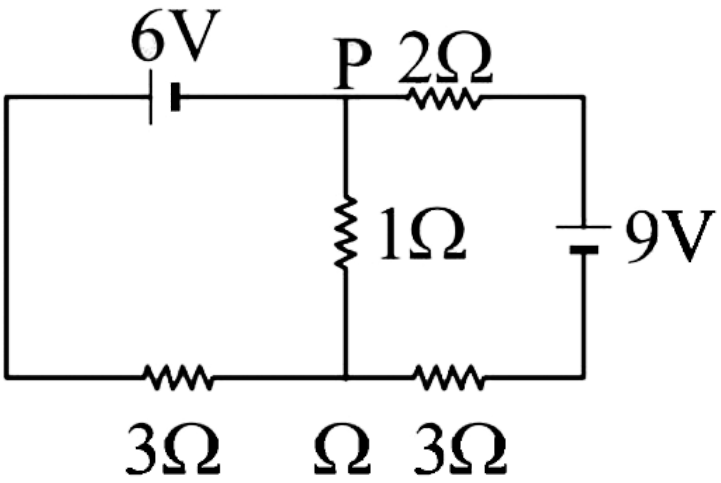
128. In the circuit shown, the current in the 1Ω resistor is :



A. $0.13A$, $\circ mQ \rightarrow P$

B. $0.13A$, $\circ mP \rightarrow Q$

C. $1.3A \circ mP \rightarrow Q$

D. 0A

Answer: A

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129. The temperature dependence of resistance of Cu and undoped Si in the temperature range $300 - 400K,$ is best described by :

A. Linear increase for Cu, exponential decrease of Si.

B. Linear decrease for Cu, linear decrease for Si.

C. Linear increase for Cu, linear increase for Si.

D. Linear increase for Cu, exponential increase for Si.

Answer: A

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