Chapter – 03

Current Electricity

Very Short Answer Type Questions

01. Name the mobile charge carriers responsible for conduction of electric current in
(i) an electrolyte (ii) an ionized gas.

02. Explain with the help of the graph, the variation of conductivity with temperature for the metallic conductor.

03. Name two factors on which the resistivity of a given material depends.

04. Draw V ~ I graph for ohmic and non-ohmic materials. Given one example for each.

05. Define the term 'resistivity' and write its S.I. unit.

06. How does the resistivity of (i) Conductor, (ii) a Semiconductor vary with temperature?

07. State the relation between current and drift velocity.

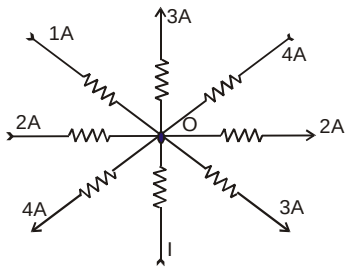
08. Keeping the mass constant, if the length of the wire is increased to n-times, what is the new resistance is changed to?

09. What are the dimensions of electrical conductivity?

10. The p.d across a given wire is increased. What happens to the drift velocity of the charge carrier?

11. What happens to the drift velocity of electrons and the resistance, if the length of the conductor is doubled, keeping the potential difference unchanged

12. Fig. shows currents in a part of the electric network. Calculate the current through resistor R.



13. A wire of resistance 20Ω is bent to form a complete circle. Find the resistance between two diametrically opposite points.

14. What is the slide wire (meter) bridge and why is the meter bridge given this name?

15. State the principle of a meter bridge?

16. Is the dimensional formula of emf the same as that of force?

17. Under what circumstance can the terminal P.d of battery exceed its emf?

18 Write the mathematical relation between mobility and drift velocity of charge carriers in a conductor.

Short Answer Type Questions

19. Draw the graph to show the variation of resistance of metal wire as a function of its diameter, keeping length and temperature constant.

20. What happens to the drift velocity of electrons and the resistance, if the length of the conductor is doubled, keeping the potential difference unchanged?

21. A metallic wire of length 1 meter is stretched to double the length. Calculate the ratio of its initial and final resistance assuming that there is no change in its density in stretching.

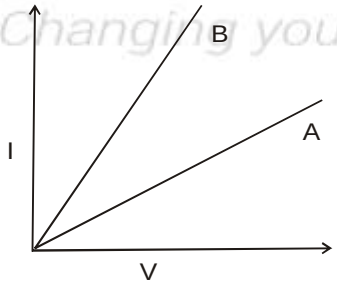
22. A wire with resistance 5R is melted out so that its new length is 3 times its original length. Find the resistance of the longer wire.

23. A wire of resistance 32 is melted and drawn into the wire of half of its original length. Calculate the resistance of the new wire. What is the percentage change in resistance?

24. Keeping the mass constant, Radius is increased n-times. Then the new resistance is. Prove it.

25. Two wires of equal length, one of copper and other of managing have the same resistance. Which wire is thicker? Give reason.

26. V-I graphs for parallel and series combination of two metallic resistances are shown in the figure. Which graph represents a parallel combination. Justify your answer.



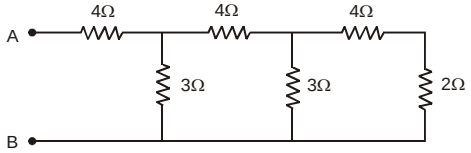
27. Draw the graph to show the variation of resistance of metal wire as a function of its diameter, keeping length and temperature constant.

28. A Potential difference of 'v' volts is applied to a conductor of length L and diameter D. How will the drift velocity of electrons and the resistance of the conductor change when (i) 'V' is doubled, (ii) L is halved (iii) 'D' is halved, while other remain constant.

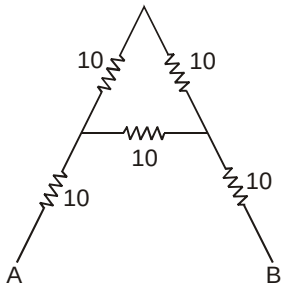
29 Derive the expression for the resistivity of a conductor in terms of the number density of free electrons and relaxation time.

Combination of Resistances

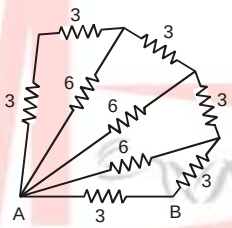
30 Calculate the equivalent resistance between points A and B in the following diagram.



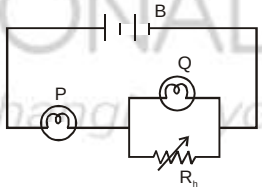
31. Find out the equivalent resistance between two points A and B of the given electrical network.



32. Find out the effective resistance between points A and B in the following electrical network.



33. The Circuit Showing a battery 'B', a rheostat R_h and identical lamps P and Q. What happens to the brightness of lamps, if the resistance through rheostat is increased ? Give reason.

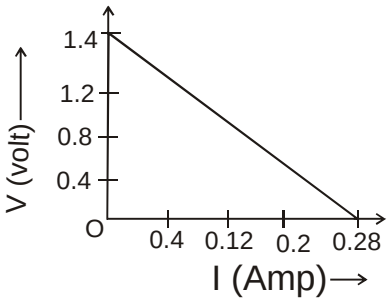


34. A graph is drawn with P.d across the terminal of the cell against the current flowing through the cell. Find out

(i) emf of cell

(ii) Maximum current obtained from the cell

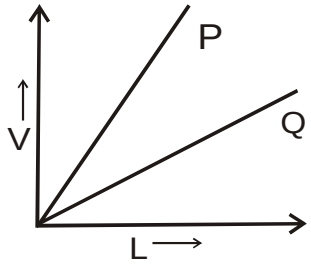
(iii) The internal resistance of the cell



35. What happens to the power dissipation, if the value of the current passing through a conductor of Constant is doubled?

36. Two bulbs of 120V, one of 25W, and the other of 200W are connected in series. One bulb burns almost instantly. Which one burns and why?

37. The variation of potential difference V with length L incase of two Potentiometer P and Q is shown. Which of these two will you prefer for comparing the emf of two primary cells?



38. What is meant by the sensitivity of a potentiometer? How can the sensitivity be increased

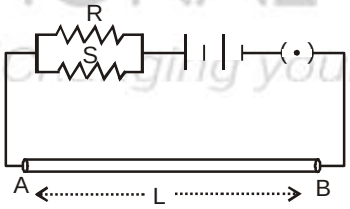
39. Why do we prefer a potentiometer with a longer bridge wire?

39. A potentiometer wire of length L and resistance R_0 is connected to a battery and a resistance combination as shown in the fig.

(i) Obtain an expression for potential drop per unit length of Potentiometer wire.

(ii) What is the maximum emf of the test cell, for which one can get a balanced point on the wire?

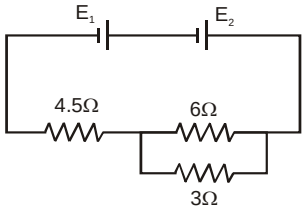
(iii) What precautions should one take while connecting this test cell in the circuit?



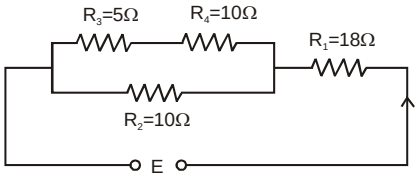
40. In a potentiometer, a standard cell of emf 5V and negligible resistance, maintain a steady current through the potentiometer wire of length 5 m. Two primary cells of EMFs E_1 and E_2 are joined in series with (i) the Same polarity (ii) Opposite polarity. The combination is connected through a galvanometer and a jockey to the potentiometer. The balancing length in two cases is found to be 350 cm and 50 cm respectively. Find the value of EMFs of the two cells.

Combination of Resistances

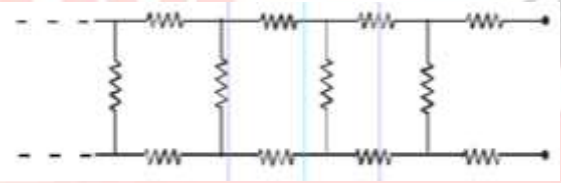
41. Two cels E_1 and E_2 in the given circuit diagram have an e.m.f. of 5v and 9v with internal resistance 0.3 Ω and 1.2 Ω respectively. Calculate the current in 3 Ω.



42. Determine the voltage drop across the resistor R_1 in the circuit given below with E = 60v.



43. Calculate the currents through resistors R_1, R_2, R_3, and R_4.



Internal Resistance:

44. Why is it easier to start a can engine on a warm day than on chilly winter days?

45. A battery of emf E and internal resistance r gives a current of 0.5A with an external resistance of 12 and a current of 0.25A with an external resistance of 25 Ω. Calculate (i) the internal resistance (ii) emf of the battery.

46. A battery has an emf of 12V and r = 2 Ω. Is the terminal P.d greater than, less than or equal to 12V if the current in the battery is

(a) From -ve to +ve terminal (b) From +ve to -ve terminal (c) Zero

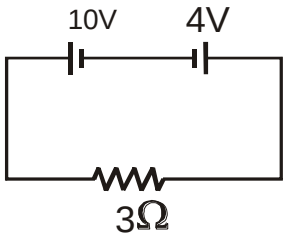
Heating Effect of Current :

47. In a circuit shown in the figure. Find out -

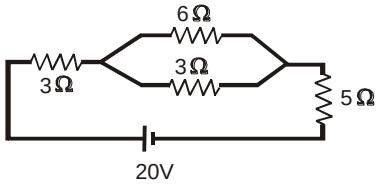
(i) Power supplied by 10V battery.

(ii) Power consumed by 4V battery.

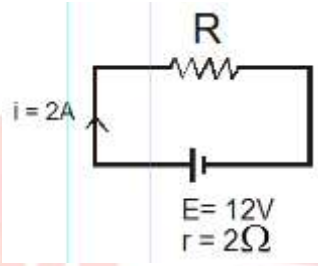
(iii) The power dissipated in 3 Ω resistors.



48. In the circuit shown the fig. Find the heat developed across each resistance in 2s.



49. Consider the following circuit. Find the power generated in the resistor R.



50. How can the loss of power be minimized from the transmission cable connecting from power station to home?

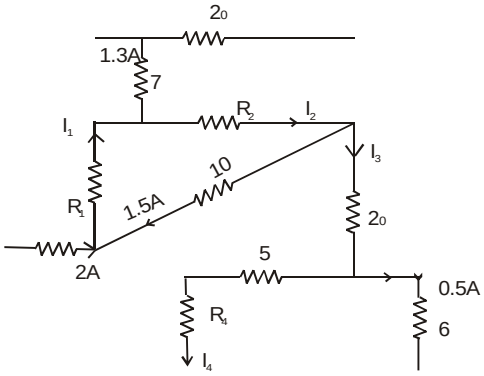
51. How much current does a Geyser rate 2KW draw, when connected to a 230V supply?

52. Two electric bulbs A and B are marked 220V, 40W, and 220V-60W and 220V-60W respectively. Which one has higher resistance?

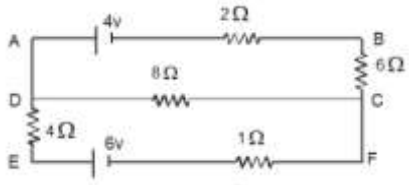
53. An electric bulb is marked 100W-230V. If the supply voltage drops to 115V, what is the heat and light energy produced by the bulb in 20 minutes?

KIRCHHOFF'S LAW

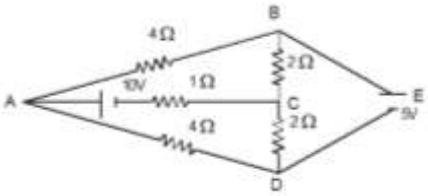
55. Find the total resistance of an infinite network shown in the figure. Each resistor has a resistance of 1.



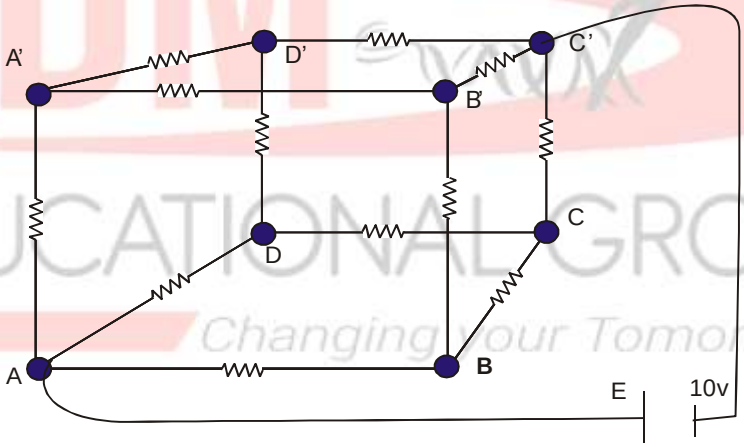
56. Using Kirchoff's Law calculates the Pd across the 8 Ω resistance.



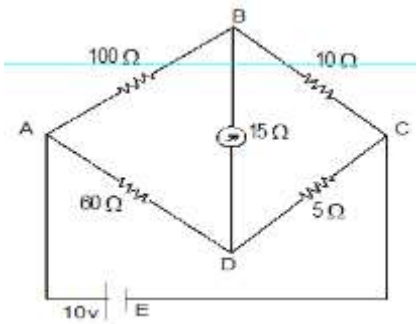
57. Determine the current in each branch of the network shown in the figure.



58. A battery of 10V and negligible internal resistance is connected across the diagonally opposite corners of a cubical network of 12 resisters each of resistance 1 Ω. Determine the equivalent resistance of the network and the current along each edge of the cube.



59. The four arms of a Wheatstone bridge have the following resistances. AB= 100 Ω, BC= 10 Ω, CD=5 Ω and DA= 60 Ω. Find the current through each resistor.

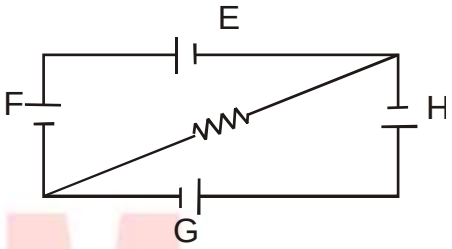


60. The cells of EMFs 1.5v and 2v and internal resistance 1 Ω and 2 Ω respectively are connected in parallel, to send currents in the same direction through an external resistance of 5 Ω. Draw the circuit diagram. Using Kirchhoff's Laws, calculate the current through each branch of the circuit, and potential difference across 5 Ω resistance.

61. In the circuit diagram E, F, G, and H are cells of emf 2, 1, 3, and 1 volt and their internal resistances are 2, 1, 3, and 1 Ω respectively. Calculate-

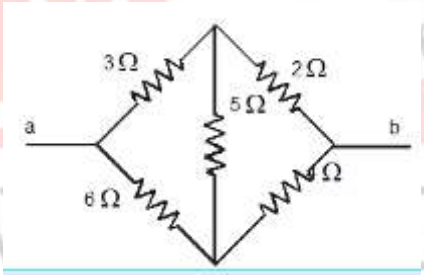
(i) The potential difference between B and D,

(ii) The potential difference across the terminals and each of the cells G and H.

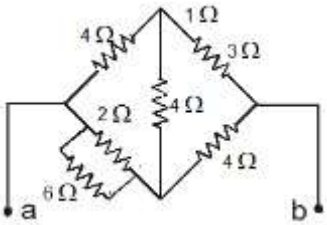


Wheatstone Bridge

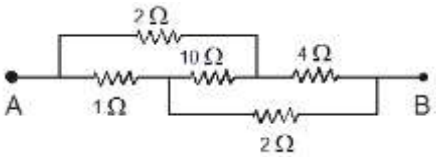
62. Find out the equivalent resistance between the points 'a' and 'b'.



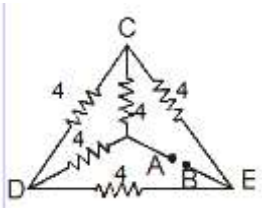
63. Calculate the equivalent resistance between the points 'a' and 'b'.



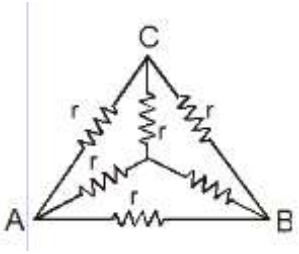
64. Calculate the resistance between A and B of the given network.



65. Calculate the effective resistance between A and B, if the resistance of each is 4 Ω .



66. Find the equivalent resistance between A and B, if the resistance of each is r.



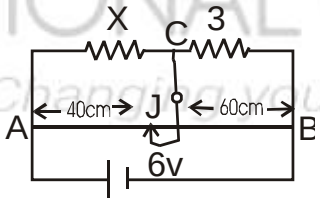
67. Kirchhoff's Law (1st Law) obeys the Law of conservation of charge, Explain.

Meter Bridge

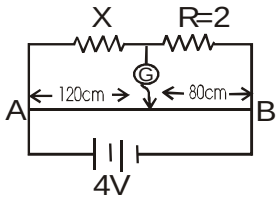
68 In a meter bridge, the length of the wire is 100 cm. At what point will the balance be obtained if the two resistances are in the ratio of 2 : 3.

69. Fig. shows a balanced meter bridge of resistance $1\Omega cm^{-1}$.

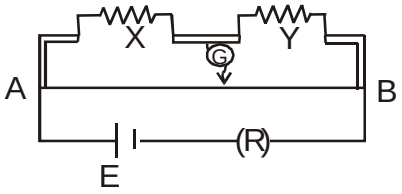
Calculate the value of unknown resistance X and current drawn from the battery of negligible internal resistance. Also, calculate the current in the upper branch.



70. Find the value of the unknown resistance X and the current drawn by the circuit from the battery, if no current flows through the galvanometer. Assume the resistance per unit length of the wire AB to be 0.01 $\Omega\,\text{cm}^{1}$.



71. In a meter bridge, the balance point is found to be at 39.5 cm from the end A, when the resistor Y is of 12.5 Ω

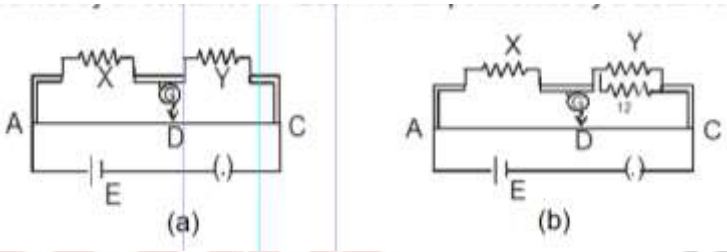


(i) Determine the resistance of X.

(ii) Why are the connections between resistors in the meter bridge made of thick copper strips?

(iii) What happens of the galvanometer and cell an interchanged at the balance point of the bridge? Would the Galvanometer show any current?

72. In a meter bridge, resistors X and Y are connected as shown. A null point is found to be at a distance of 33.7 cm from the end A. The resistance y is shunted by a resistance of 12 Ω.The null point shifts by a distance of 18.2 cm. Determine the resistance of x and y.



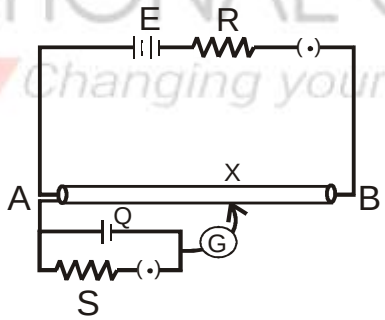
Potentiometer

73. Three students X, Y, and Z perform an experiment on the Potentiometer separately using the circuit diagram shown. Keeping other things unchanged

(i) Y - decreases the value of S.

(ii) Z - replaces the battery E by a cell of high-value emf.

(iii) X - increases the value of R



How would these changes affect the position of a null point in each case and why?

74. In the potentiometer circuit shown, the null point is at x. State with reason, where the balance point will be shifted when,

(a) Resistance R is increased, keeping all other parameters unchanged.

(b) Resistance S is increased, keeping R constant.