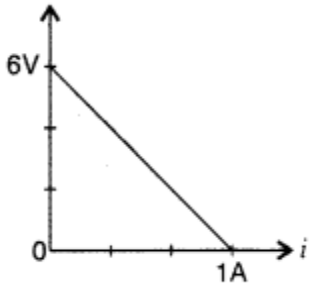
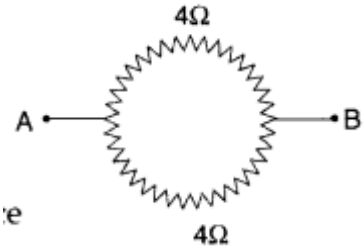
CLASS 12 PHYSICSS PREVIOUS YEAR QUESTIONS
CURRENT ELECTRICITY

Question 1. The plot of the variation of potential difference across a combination of three identical cells in series, versus current is as shown in the figure. What is the emf of each cell? (Delhi 2008)



Question 2. A wire of resistance 8R is bent in the form of a circle. What is the effective resistance between the ends of a A diameter 2AB? (Delhi 2008)



Question 3. Two conducting wires X and Y of same diameter across a battery. If the number density of electro in X is twice that in Y, find the ratio of drift velocity of electrons in the two wires. (All India 2008)

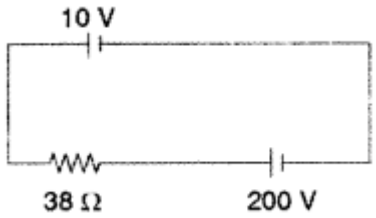
Question 4. A resistance R is connected across a cell of emf ε and internal resestance r. A potentiometer now measures the potential difference between the terminals of the cell as V. write the expression for 'r' in terms of ε, V and R. (Delhi 2011)

Question 5. When electrons drift in a metal from lower to higher potential, does it mean that all the free electrons of the metal are moving in the same direction? (Delhi 2012)

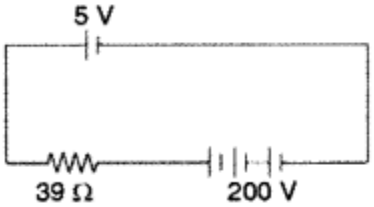
Question 6. Show on a graph the variation of resistivity with temperature for a typical semiconductor . (Delhi 2012)

Question 7. Two wires of equal length, one of copper and the other of manganin have the same resistance. Which wire is thicker? (All India 2012)

Question 8. A 10 v battery of negligible internal resistance is connected across a 200 V battery and a resistance of 38Ω as shown in the figure. Find the value of the current in circuit. (Delhi 2013)



Question 9. A 5 V battery of negligible internal resistance is connected across a 200 V battery and a resistance of 39 Ω as shown in the figure. Find the value of the current (Delhi 2013)



Question 10. The emf of a cell is always greater than its terminal voltage. Why? Give reason. (Delhi 2013)

Question 11. A cell of emf 'E' and internal resistance 'r' draws a current 'I'. Write the relation between terminal voltage 'V' in terms of E, I and r. (Delhi 2013)

Question 12. Two identical cells, each of emf E, having negligible internal resistance, are connected in parallel with each other across an external resistance R. What is the current through this resistance ?

Question 13. Why is the terminal voltage of a cell less than its emf? (Comptt. All India 2013)

Question 14. Two students A and B were asked to pick a resistor of 15 kΩ from a collection of carbon resis-tors. A picked a resistor with bands of colours : brown, green, orange while B chose a resistor with bands of black, green, red. Who picked the correct resistor? (Comptt. All India 2013)

Question 15. Define the term 'Mobility' of charge carriers in a conductor. Write its S.I. unit. (Delhi 2014)

Question 16. Show variation of resistivity of copper as a function of temperature in a graph. (Delhi 2014)

Question 17. Define the term 'electrical conductivity' of a metallic wire. Write its S.I. unit. (Delhi 2014)

Question 18. Define the term 'drift velocity' of charge carriers in a conductor and write its relationship with the current flowing through it. (Delhi 2014)

Question 19. How does the random motion of free electrons in a conductor get affected when a potential difference is applied across its ends? (Comptt. Delhi 2014)

Question 20. State the underlying principle of a potentiometer. (Comptt. Delhi 2014)

Question 21. Write the expression for the drift velocity of charge carriers in a conductor of

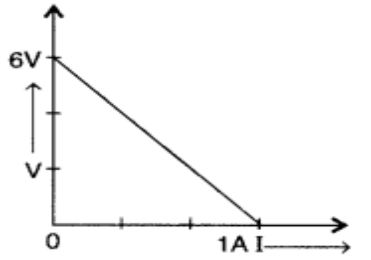
length T across which a potential difference 'V' is applied. (Comptt. All India 2014)

Question 22. How does one explain increase in resistivity of a metal with increase of temperature? (Comptt. All India 2014)

Question 23. Graph showing the variation of current versus voltage for a material GaAs is shown in the figure. Identify the region of
(i) negative resistance
(ii) where Ohm's law is obeyes (Delhi 2014)
versus for a GaAs is in the Identify the region of

Question 24. I – V graph for a metallic wire at two different temperatures, T_1 and T_2 is as shown in the figure. Which of the two temperatures is lower and why? (All India 2015)

Question 25. The plot of the variation of potential difference A across a combination of three identical cells in series, versus current is shown along the question. What is the emf and internal resistance of each cell? (All India 2016)



Question 26. Why is a potentiometer preferred over a voltmeter for determining the emf of a cell? (Comptt. Delhi 2016)

Question 27. Nichrome and copper wires of same length and same radius are connected in series. Current I is passed through them. Which wire gets heated up more? Justify your answer. (Outside Delhi 2017)

Question 28. Define the conductivity of a conductor. Write its SI unit. (Comptt. Outside Delhi 2017)

Question 29. Two metallic wires of the same material have the same length but cross-sectional area is in the ratio 1 : 2. They are connected
(i) in series and
(ii) in parallel. Compare the drift velocities of electrons in the two wires in both the cases (i) and (ii). (All India 2008)

Question 30. Derive an expression for the resistivity of a good conductor, in terms of the relaxation time of electrons. (All India 2008)

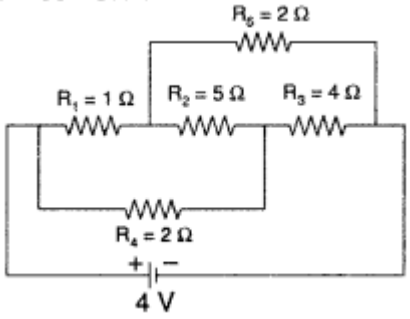
Question 31. Using the mathematical expression for the conductivity of a material, explain how it varies with temperature for
(i) semiconductors,
(ii) good conductors. (All India 2008)

Question 32. A cell of emf 'E' and internal resistance V is connected across a variable resistor

'R'. Plot a graph showing the variation of terminal potential 'V' with resistance R.
Predict from the graph the condition under which 'V' becomes equal to 'E'. (Delhi 2009)

Question 33. Derive an expression for drift velocity of free electrons in a conductor in terms of relaxation time. (Delhi 2009)

Question 34. Calculate the current drawn from the battery in the given network. (All India 2009)

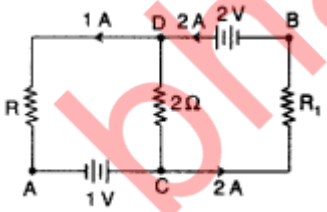


Question 35. Define current sensitivity and voltage sensitivity of a galvanometer. Increasing the current sensitivity may not necessarily increase the voltage sensitivity of a galvanometer. Justify. (All India 2009)

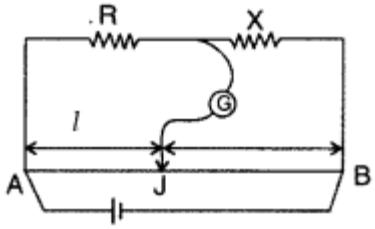
Question 36. A wire of 15 Ω resistance is gradually stretched to double its original length. It is then cut into two equal parts. These parts are then connected in parallel across a 3.0 volt battery. Find the current drawn from the battery. (All India 2009)

Question 37. A wire of 20 Ω resistance is gradually stretched to double its original length. It is then cut into two equal parts. These parts are then connected in parallel across a 4.0 volt battery. Find the current drawn from the battery. (All India 2009)

Question 38. In the given circuit, assuming point A to be at zero potential, use Kirchhoff's rules to determine the potential A at point B. (All India 2011)



Question 39. In the meter bridge experiment, balance point was observed at J with AJ = l.



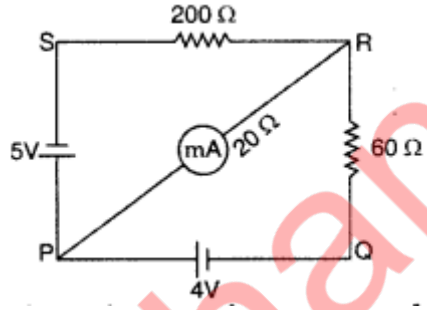
(i) The values of R and X were doubled and then interchanged. What would be the new position of balance point?
(ii) If the galvanometer and battery are interchanged at the balance position, how will the balance point get affected? (All India 2011)

Question 40. A cell of emf E and internal resistance r is connected to two external resistances R_1 and R_2 and a perfect ammeter. The current in the circuit is measured in four different situations:
(i) without any external resistance in the circuit
(ii) with resistance R_2 only
(iii) with R_1 and R_2 in series combination
(iv) with R_1 and R_2 in parallel combination
The currents measured in the four cases are 0.42A, 1.05A, 1.4A and 4.2A, but not necessarily in that order. Identify the currents corresponding to the four cases mentioned above.

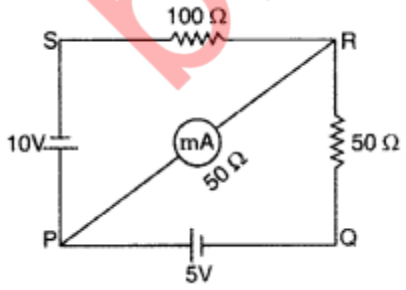
Question 41. A battery of emf 10 V and internal resistance 3Ω is connected to a resistor. If the current in the circuit is 0.5 A, find
(i) the resistance of the resistor;
(ii) the terminal voltage of the battery. (Comptt. Delhi 2012)

Question 42. A battery of emf 6 V and internal resistance 2Ω is connected to a resistor. If the current in the circuit is 0.25 A, find
(i) the resistance of the resistors;
(ii) the terminal voltage of the battery. (Comptt. Delhi)

Question 43. The network PQRS, shown in the circuit diagram, has the batteries of 4 V and 5 V and negligible internal resistance. A milliammeter of 20 Ω resistance is connected between P and R. Calculate the reading in the milliammeter. (Comptt. All India 2012)



Question 44. The network PQRS, shown m the circuit diagram, has the batteries of 5 V and 10 V and negligible internal resistance. A milliammeter of 50Ω resistance is connected between P and R. Calculate the reading in the milliammeter. (Comptt. All India 2012)



Question 45. State the principle of a potentiometer. Describe briefly, with the help of a circuit diagram, how this device is used to compare the emf's of two cells. (Comptt. All India 2012)

Question 46. An ammeter of resitance 1 Ω can measure current upto 1.0 A
(i) What must be the value of the shunt resistance to enable the ammeter to measure upto 5.0 (A)?
(ii) What is the combined resistance of the ammeter and the shunt? (Delhi 2013)

Question 47. Explain the term 'drift velocity' of electrons in a conductor. Hence obtain the expression for the current through a conductor in terms of 'drift velocity'

Question 48. Write the expression for the current in a conductor of cross-sectional area A in terms of drift velocity. (Comptt. All India 2013)

Question 49. Describe briefly, with the help of a circuit diagram, how a potentiometer is used to determine the internal resistance of a cell.
(All India 2013)

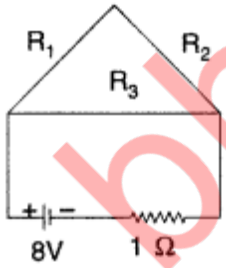
Question 50. Write a relation between current and drift veloc¬ity of electrons in a conductor. Use this relation to explain how the resistance of a conductor changes with the rise in temperature. (Comptt. Delhi 2013)

Question 52. Draw a graph showing variation of resistivity with temperature for nichrome. Which property of nichrome is used to make standard resistance coils? (Comptt. All India 2013)

Question 53. A battery of emf E and internal resistance r when connected across an external resistance of 12 ft, produces a current of 0.5 A. When connected across a resistance of 25 ft, it produces a current of 0.25 A. Determine
(i) the emf and
(ii) the internal resistance of the cell. (Comptt. All India 2013)

Question 54. Define mobility of a charge carrier. Write the relation expressing mobility in terms of relaxation time. Give its SI unit. (Comptt. All India 2013)

Question 55. A uniform wire of resistance 12 Ω is cut into three pieces so that the ratio of the resistances $R_1 : R_2 : R_3 = 1 : 2 : 3$ and the three pieces are connected to form a triangle across which a cell of emf 8V and internal resistance



1 Ω is connected as shown. Calculate the current through each part of the circuit. (Comptt. All India 2013)

Question 56. State Kirchhoff's rules. Explain briefly how these rules are justified. (Delhi 2014)

Question 57. A cell of emf 'E' and internal resistance V is connected across a variable resistor 'R'. Plot a graph showing variation of terminal voltage 'V' of the cell versus the current 'I'. Using the plot, show how the emf of the cell and its internal resistance can be determined. (All India 2014)

Question 58. Estimate the average drift speed of conduction electrons in a copper wire of cross-sectional area 1.0×10^{-7} m^2 carrying a current of 1.5 A. Assume the density of conduction electrons to be 9×10^{28} m^{-3}. (All India 2014)

Question 59. Estimate the average drift speed of conduction electrons in a copper wire of cross-

sectional area 2.5×10^{-7} m^2 carrying a current of 1.8 A. Assume the density of conduction electrons to be 9×10^{28} m^{-3}. (All India 2014)

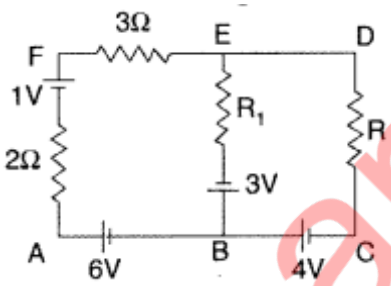
Question 60. Estimate the average drift speed of conduction electrons in a copper wire of cross-sectional area 2.5×10^{-7} m^2 carrying a current of 2.7 A. Assume the density of conduction electrons to be 9×10^{28} m^{-3}. (All India 2014)

Question 61. Draw a plot showing the variation of resistivity of a
(i) conductor and
(ii) semiconductor, with the increase in temperature.
How does one explain this behaviour in terms of number density of charge carriers and the relaxation time? (Comptt. Delhi 2014)

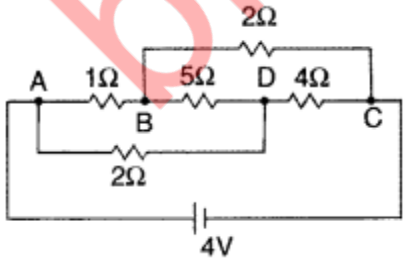
Question 62. Distinguish between emf (ε) and terminal voltage (V) of a cell having internal resistance r. Draw a plot showing the variation of terminal voltage (V) vs the current (I) drawn from the cell. Using this plot, how does one determine the internal resistance of the cell?
– (Comptt All India 2014)

Question 63. Use Kirchhoff's rules to obtain conditions for the balance condition in a Wheatstone bridge. (Delhi 2015)

Question 64. Use Kirchhoff's rules to determine the potential difference between the points A and D when no current flows in the arm BE of the electric network shown in the figure.



Question 65. Calculate the current drawn from the battery by the network of resistors shown in the figure. (Comptt. All India 2015)

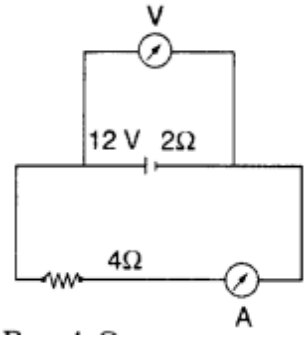


Question 66. Using the concept of drift velocity of charge carriers in a conductor, deduce the relationship between current density and resistivity of the conductor. (Comptt. Delhi 2015)

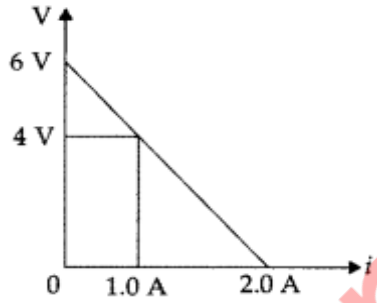
Question 67. Two cells of emfs 1.5 V and 2.0 V having internal resistance 0.2 Ω and 0.3 Ω respectively are connected in parallel. Calculate the emf and internal resistance of the equivalent cell.(Delhi 2016)

Question 68. A battery of emf 12V and internal resistance 2 Ω is connected to a 4 Ω resistor as shown in the figure.

(a) Show that a voltmeter when placed across the cell and across the resistor, in turn, gives the
(b) To record the voltage and the current in the circuit, why is voltmeter placed in parallel and ammeter in series in the circuit? (All India)



Question 69. The figure shows a plot of terminal voltage 'V' versus the current 'i' of a given cell. Calculate from the graph
(a) emf of the cell and
(b) internal resistance of the cell. (Comptt. Outside Delhi 2017)



Question 70. A cell of emf 4 V and internal resistance 1 Ω is connected to a d.c. source of 10 V through a resistor of 5 Ω. Calculate the terminal voltage across the cell during charging.

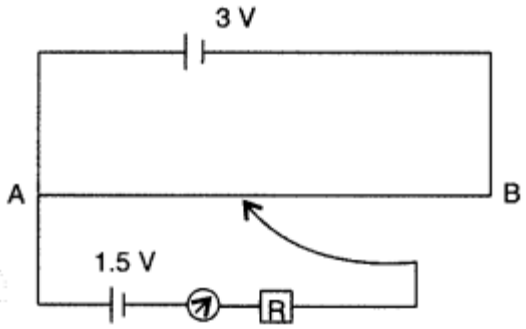
Question 71. Prove that the current density of a metallic conductor is directly proportional to the drift speed of electrons. (Delhi 2008)

Or

Derive an expression for the current density of a conductor in terms of the drift speed of electrons. (All India 2008)

Question 72. A number of identical cells n, each of emf e, internal resistance r connected in series are charged by a d.c. source of emf elr using a resistor R.
(i) Draw the circuit arrangement.
(ii) Deduce the expressions for
(a) the charging current and
(b) the potential difference across the combination of the cells. (Delhi 2008)

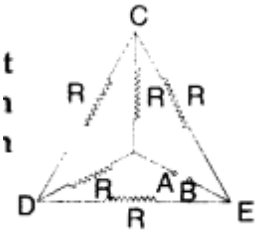
Question 73. A potentiometer wire of length 1 m is connected to a driver cell of emf 3 V as shown in the figure. When a cell of 1.5 V emf is used in the secondary circuit, the balance point is found to be 60 cm. On replacing this cell and using a cell of unknown emf, the balance point shifts to 80 cm.



(i) Calculate unknown emf of the cell.
(ii) Explain with reason, whether the circuit works, if the driver cell is replaced with a cell of emf 1 V.
(iii) Does the high resistance R, used in the secondary circuit affect the balance point? Justify your answer. (Delhi 2008)

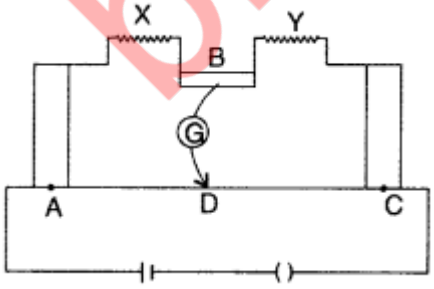
Question 74. Define resistivity of a conductor. Plot a graph showing the variation of resistivity with temperature for a metallic conductor. How does one explain such a behaviour, using the mathematical expression of the resistivity of a material. (Delhi 2008)

Question 75. (i) Calculate the equivalent resistance of the given electrical network between points A and B.



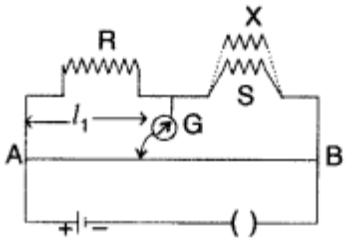
(ii) Also calculate the current through CD and ACB, if a 10 V d.c. source is connected between A and B, and the value of R is assumed as 2 Ω. (All India 2008)

Question 76. The figure shows experimental set up of a meter bridge. When the two unknown resistances X and Y are inserted, the null point D is obtained 40 cm from the end A. When a resistance of 10 Ω is connected in series with X, the null point shifts by 10 cm.



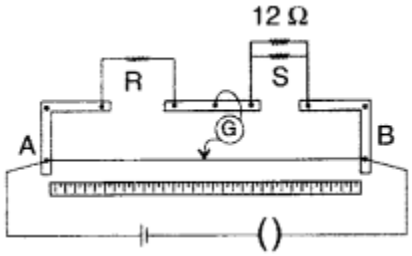
Find the position of the null point when the 10 Ω resistance is instead connected in series with resistance 'Y'. Determine the values of the resistances X and Y. (Delhi 2008)

Question 77. (i) State the principle of working of a meter bridge. x
(ii) In a meter bridge balance point is found at a distance l_1 with resistances R and S as shown in the figure.
When an unknown resistance X is connected in parallel with the resistance S, the balance point shifts to a distance l_2. Find the expression for X in terms of l_1 l_2 and S. (All India 2009)

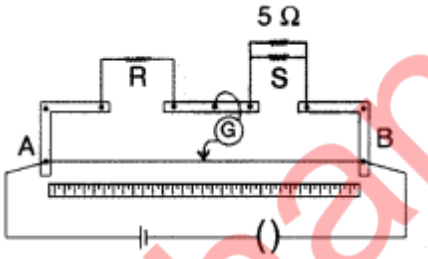


Question 78. Write the principle of working of a potentiometer. Describe briefly, with the help of a circuit diagram, how a potentiometer is used to determine the internal resistance of a given cell. (Delhi 2009)

Question 79. In a meter bridge, the null point is found at a distance of 40 cm from A. If a resistance of 12 Ω is connected in parallel with S, the null point occurs at 50.0 cm from A. Determine the values of R and S ?
Answer:

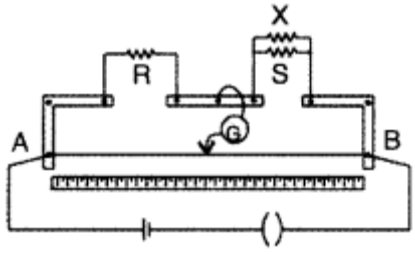


Question 80. In a meter bridge, the null point is found at a distance of 60.0 cm from A.

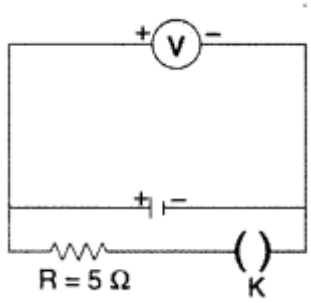


If now a resistance of 5 Q is connected in series with S, the null point occurs at 50 cm. Determine the values of R and S. (Delhi 2010)

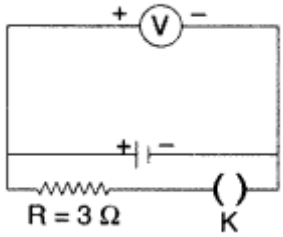
Question 81. In a meter bridge, the null point is found at a distance of l_1 cm from A. If now a resistance of X is connected in parallel with S, the null point occurs at l_2. Obtain a formula for X in terms of l_1 l_2 and S. (Delhi 2010)



Question 82. Write any two factors on which internal resistance of a cell depends. The reading on a high resistance voltmeter, when a cell is connected across it, is 2.2 V. When the terminals of the cell are also connected to a resistance of 5 Ω as shown in the circuit, the voltmeter reading drops to 1.8 V. Find the internal resistance of the cell. (All India 2010)

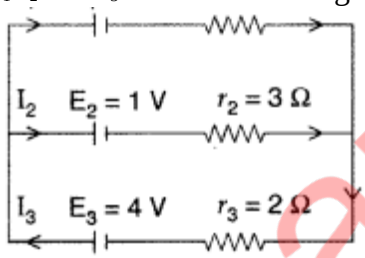


Question 83. Write any two factors on which internal resistance of a cell depends. The reading on a high resistance voltmeter, when a cell is connected across it, is 2.0 V.

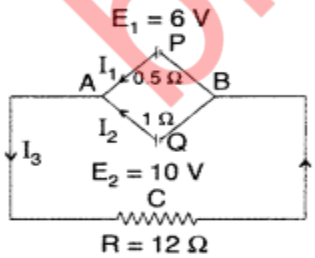


When the terminals of the cell are also connected to a resistance of 3Ω as shown in the circuit, the voltmeter reading drops to 1.5 V. Find the internal resistance of the cell. (All India 2010)

Question 84. State Kirchhoff's rules. Use these rules to write the expressions for the current I_1 I_2 and I_3 in the circuit diagram shown. (All India 2010)



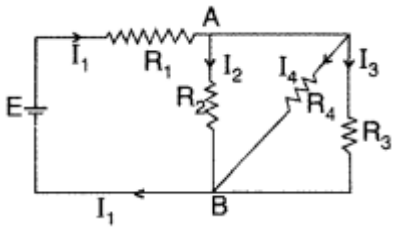
Question 85. State Kirchhoff's rules. Apply Kirchhoff's rales to the loops ACBPA and ACBQA to write the expressions for the currents I_1, I_2 and I_3 in the network. (All India 2010)



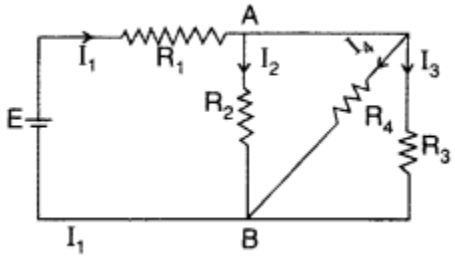
Question 87. Define the terms
(i) drift velocity,
(ii) relaxation time.
A conductor of length L is connected to a dc source of emf e. If this conductor is replaced by another conductor of same material and same area of cross-section but of length 3L, how will the drift velocity change? (Delhi 2010)

Question 88. In the circuit shown, $R_1 = 4\Omega$, $R_2 = R_3 = 15\ \Omega$, $R_4 = 30\Omega$ and E = 10V. Calculate the

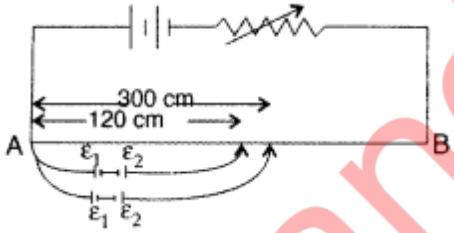
equivalent resistance of the circuit and the current in each resistor. (Delhi 2010)



Question 89. In the circuit shown, R1 = 4Ω, R2 = R3 = 5Ω, R4 = 10Ω and E = 6V. Work out the equivalent resistance of the circuit and the current in each resistor. (Delhi 2010)

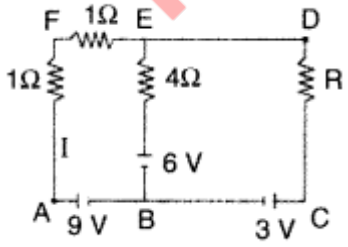


Question 90. In the figure a long uniform potentiometer wire AB is having a constant potential gradient along its length. The null points for the two primary cells of emfs ε_1 and ε_2 connected in the manner shown are obtained at a distance of 120 cm and 300 cm from the end A.

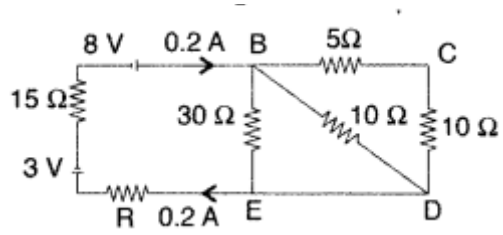


Find (i) $\varepsilon_1/\varepsilon_2$
(ii) position of null point for the cell ε_1
How is the sensitivity of a potentiometer increased ?

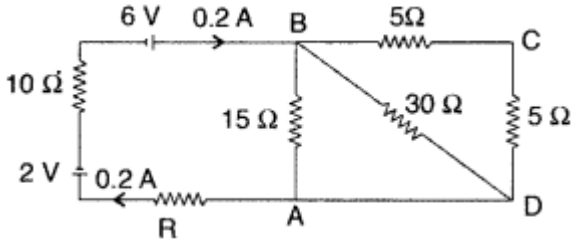
Question 91. Using Kirchoff's rules determine the value of unknown resistance R into circuit so that no current flows through 4ω resistance. Also find the potential difference between A and D. (Delhi 2012)



Question 92. Calculate the value of the resistance R in the circuit shown in the figure so that the current in the circuit is 0.2 A. What would be the potential difference between points B and E? (All India 2012)

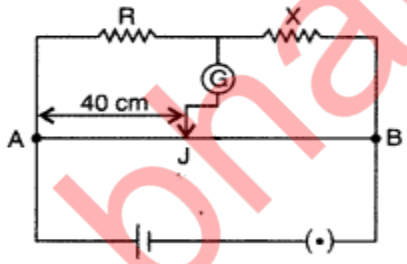


Question 93. Calculate the value of the resistance R in the circuit shown in the figure so that the current is 0.2 A. What would be the potential difference between points A and B?



Question 94. Define relaxation time of the free electrons drifting in a conductor. How is it related to the drift velocity of free electrons? Use this relation to deduce the expression for the electrical resistivity of the material. (All India 2012)

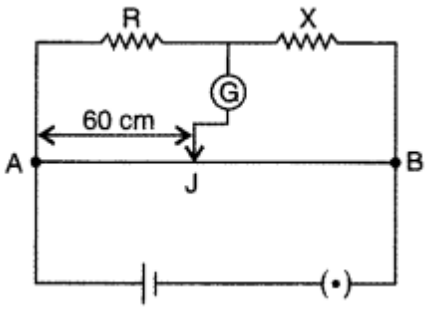
Question 95. Write the principle on which the working of a meter bridge is based. In an experiment on meter bridge, a student obtains the balance point at the point J such that AJ = 40 cm as shown in the figure. The values of 'R' and 'X' are both doubled and then interchanged. Find the new position of the balance point. If the galvanometer and battery are also interchanged, how will the position of balance point be affected? (Comptt. All India 2012)



Question 96. Write the principle on which the working of a meter bridge is based. In an experiment on meter bridge, a student obtains the balance point at the point J such that AJ = 60 cm as shown in the figure. The values of 'R' and 'X' are both doubled and then interchanged. Find the new position of the balance point. If the galvanometer and battery are also interchanged, how will the position of balance point be affected? (Comptt. All India 2012)

Answer:

The principle on which the working of a meter bridge is based, is Wheatstone bridge.



If the galvanometer and battery are interchanged, then there will be no effect on the position of balancing point.

Question 97. Define the current sensitivity of galvanometer. Write its S.I. unit.

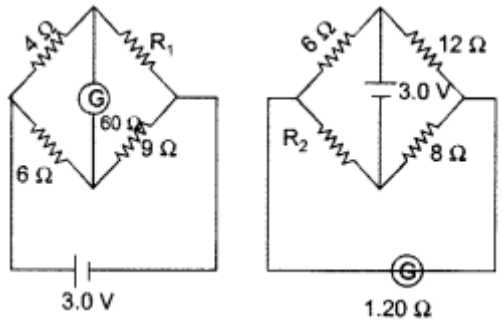
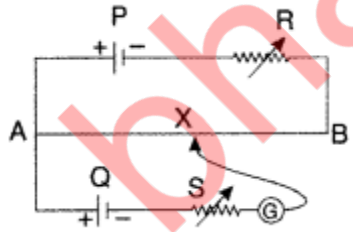


Figure shows two circuits each having a galvanometer and a battery of 3 V.
When the galvanometers in each arrangment do not show any deflection, obtain the ratio R_1/R_2. (All India 2012)

Question 98. State the underlying principle of a potentiometer. Write two factors on which the sensitivity of a potentiometer depends.
In the potentiometer circuit shown in the figure, the balance point is at X. State, giving reason, how the balance point is shifted when



(i) resistance R is increased?
(ii) resistance S is increased, keeping R constant? (Comptt. Delhi 2012)

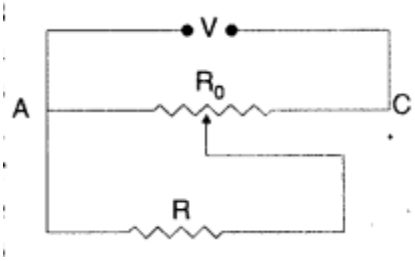
Question 99. A potentiometer wire of length 1 m has a resistance of 10 Ω. It is connected to a 6 V battery in series with a resistance of 5 Ω. Determine the emf of the primary cell which gives a balance point at 40 cm. (Delhi 2012)

Question 100. A potentiometer wire of length 1.0 m has a resistance of 15 Ω. It is connected to a 5 V battery in series with a resistance of 5 Ω. Determine the emf of the primary cell which gives a balance point at 60 cm. (Delhi 2012)

Question 101. A potentiometer wire of length 1 m has a resistance of 5 Ω. It is connected to a 8 V battery in series with a resistance of 15 Ω. Determine the emf of the primary cell which gives a balance point at 60 cm. (Delhi 2012)

Question 102. Answer the following :
(a) Why are the connections between the resistors in a meter bridge made of thick copper strips?
(b) Why is it generally preferred to obtain the balance point in the middle of the meter bridge wire?
(c) Which material is used for the meter bridge wire and why? (All India 2012)

Question 103. A resistance of R Ω draws current from a potentiometer shown in the figure.



The potentiometer has a total resistance R_0 Ω. 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.

Question 104. In the electric network shown in the figure, use Kirchhoffs rules to calculate the power consumed by the resistance R = 4 Ω. (Comptt. Delhi 2012)

Question 105. In the electric network shown in the figure use Kirchhoffs rules to calculate the power consumed by the resistance R = 8 Ω. (Comptt. Delhi 2012)

Question 106. (a) State the underlying principle of a potentiometer. Why is it necessary to
(i) use a long wire,
(ii) have uniform area of cross-section of the wire and
(iii) use a driving cell whose emf is taken to be greater than the emfs of the primary cells?
(b) In a potentiometer experiment, if the area of the cross-section of the wire increases uniformly from one end to the other, draw a graph showing how potential gradient would vary as the length of the wire increases from one end.(Comptt. All India 2012)

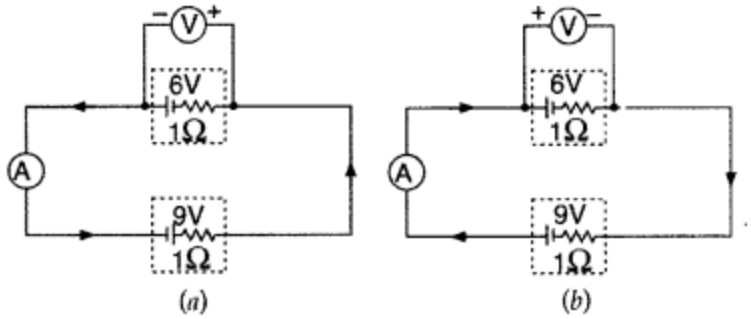
Question 107. A cell of emf 'E' and internal resistance V is connected across a variable load resistor R. Draw the plots of the terminal voltage V versus
(i) R and
(ii) the current I.
It is found that when R = 4 Ω, the current is 1 A and when R is increased to 9 Ω, the current reduces to 0.5 A. Find the values of the emf E and internal resistance r. (Delhi 2012)

Question 108. State the principle of working of a galvanometer.
A galvanometer of resistance G is converted into a voltmeter to measure upto V volts by connecting a resistance Rx in series with the coil. If a resistance R_2 is connected in series with it, then it can measure upto V/2 volts. Find the resistance, in terms of R_1 and R_2, required to be connected to convert it into a voltmeter that can read upto 2V. Also find the resistance G of the galvanometer in terms of R_1 and R_2. (Delhi 2012)

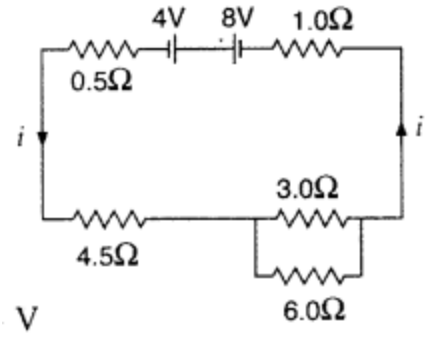
Question 109. Find the relation between drift velocity and relaxation time of charge carriers in a conductor. A conductor of length L is connected to a d,c. source of emf 'E'. If the length of the conductor is tripled by stretching it, keeping 'E' constant, explain how its drift velocity would be affected. (All India 2012)

Question 110.

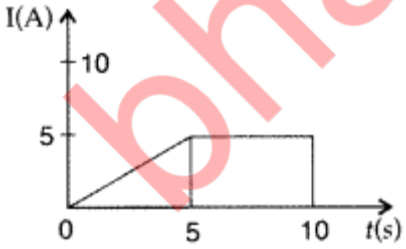
In the two electric circuits shown in the figure, determine the reading of ideal ammeter (A) and the ideal voltmeter (V). (Comptt. Delhi 2012)



Question 111. In the circuit shown in the figure, find the current through each resistor. (Comptt. Delhi 2012)



Question 112. (a) Deduce the relation between current I flowing through a conductor and drift velocity v_d of the electrons.
(b) Figure shows a plot of current 'I' flowing through the cross-section 5 of a wire versus the time 't'. Use the plot to find the charge flowing in 10s through the wire.



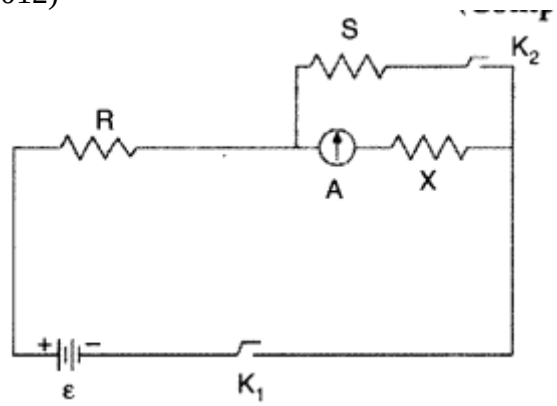
(Comptt. All India 2012)

Question 113. With the help of the circuit diagram, explain the working principle of meter bridge. How is it used to determine the unknown resistance of a given wire? Write the necessary precautions to minimize the error in the result. (Comptt. All India 2012)

Question 114. (i) Derive an expression for drift velocity of free electrons.
(ii) How does drift velocity of electrons in a metallic conductor vary with increase in temperature? Explain. (All India)

Question 115. The reading of the (ideal) ammeter, in the circuit shown here, equals :
(i) I when key K_1 is closed but key K_2 is open.
(ii) I2 when both keys K_1 and K_2 are closed.

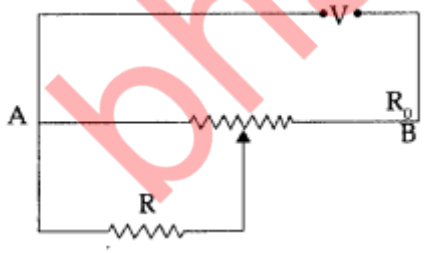
Find the expression for the resistance of X in terms of the resistances of R and S. (Comptt. Delhi 2012)



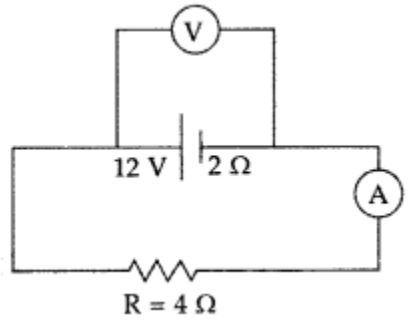
Question 115. The temperature coefficient of resistivity, for two materials A and B, are 0.0031/°C and 0.0068/ °C, respectively.
Two resistors, R_1 and R_2 made from materials A and B, respectively, have resistances of 200Ω and 100Ω at 0°C. Show on a diagram, the 'colour code', of a carbon resistor, that would have a resistance equal to the series combination of R_1 and R_2, at a temperature of 100°C.
(Neglect the ring corresponding to the tolerance of the carbon resistor) (comptt. Delhi 2012)

Question 116. A student connects a cell, of emf E_2 and internal resistance r_2 with a cell of emf E_1 and internal resistance r_1, such that their combination has a net internal combination resistance R.
Draw a diagram of the 'set-up' and obtain an expression for the current flowing through the resistance R. (Comptt. Outside Delhi 2016)

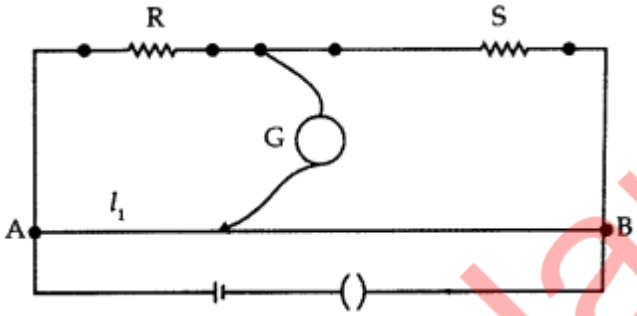
Question 119. A resistance of R draws current from a potentiometer. The potentiometer wire, AB, has a total resistance of R0. A voltage V is supplied to the potentiometer. Derive an expression for the voltage across R when the sliding contact is in the middle of potentiometer wire. (Delhi 2016)



Question 117. (a) The potential difference applied across a given resistor is altered so that the heat produced per second increases by a factor of 9. By what factor does the applied potential difference change?
(b) In the figure shown, an ammeter A and a resistor of 40 are connected to the terminals of the source. The emf of the source is 12 V having an internal resistance of 2 O. Calculate the voltmeter and ammeter readings. (Outside Delhi 2017)



Question 118. (a) write the principle of working of a metre bridge.
(b) In a metre bridge, the balance point is found at a distance l_1 with resistances R and S as shown in the figure.
An unknown resistance X is now connected in parallel to the resistance S and the balance point is found at a distance l_2. Obtain a formula for X in terms of l_1, l_2 and S. (Outside Delhi 2017)

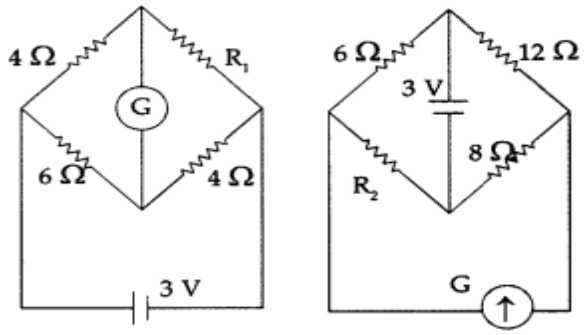


An unknown resistance X is now connected in parallel to the resistance S and the balance point is found at a distance l_2. Obtain a formula for X in terms of l_1 l_2 and S. (Outside Delhi) R

Question 119. Derive the expression for the current density of a conductor in terms of the conductivity and applied electric field. Explain, with reason how the mobility of electrons in a conductor changes when the potential difference applied is doubled, keeping the temperature of the conductor constant. (Comptt. Delhi 2017)

(*ii*) Mobility, $\mu = \frac{v_d}{E} = \frac{v_d}{\frac{V}{l}}$

Question 120. Define the term current sensitivity of a galvanotmer. In the circuits shown in the figures, the galvanometer shows no deflection in each case. Find the ratio of R_1 and R_2. (Comptt. All India 2017)



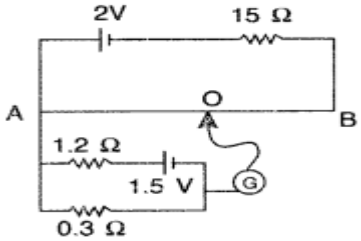
Question 121. (a) Derive the relation between current density '$J\rightarrow$' and potential difference 'V' across a current carrying conductor of length area of cross-section 'A' and the number density of free electrons.
(b) Estimate the average drift speed of conduc¬tion electrons in a copper wire of cross-sectional

area 1.0×10^{-7} m^2 carrying a current of 1.5 A. [Assume that the number density of conduction electrons is 9×10^{28} m^{-3}] (Comptt. Delhi 2012)

Question 122. (a) State the working principle of a potentiometer. With the help of the circuit diagram, explain how a potentiometer is used to compare the emf's of two primary cells. Obtain the required expression used for comparing the emfs.
(b) Write two possible causes for one sided deflection in a potentiometer experiment. (Delhi 2012)

Question 123.(i) Define the term drift velocity.
(ii) On the basis of electron drift, derive an expression for resistivity of a conductor in terms of number density of free electrons and relaxation time. On what factors does resistivity of a conductor depend?
(iii) Why alloys like constantan and manganin are used for making standard resistors? (Delhi 2017)

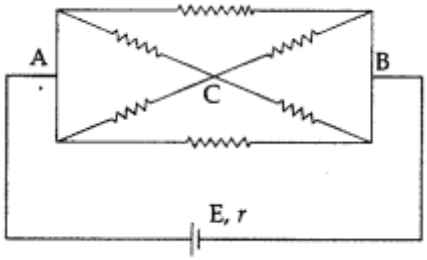
Question 124. State the principle potentiometer.
(ii) In the given potentiometer circuit AB is a uniform wire of length 1 m and resistance 10Ω. Calculate the potential gradient along the wire and balance length AO (= l). (Delhi 2017)



Question 125. (a) Why do the 'free electrons', in a metal wire, 'flowing by themselves', not cause any current flow in the wire?
Define 'drift velocity' and obtain an expression for the current flowing in a wire, in terms of the 'drift velocity' of the free electrons.
(b) Use the above expression to show that the 'resistivity', of the material of a wire, is' inversely proportional to the 'relaxation time' for the 'free electrons' in the metal. (Comptt. Outside Delhi 2016)

Question 126. (i) Derive a26n expression for drift velocity of electrons in a conductor. Hence deduce Ohm's law.
(ii) A wire whose cross-sectional area is increasing linearly from its one end to the other, is connected across a battery of V volts. Which of the following quantities remain constant in the wire?
(a) drift speed
(b) current density
(c) electric current (d) electric field Justify your answer. (Delhi 2016)

Question 127. (a) State the two Kirchhoff's laws. Explain briefly how these rules are justified.
(b) The current is drawn from a cell of emf E and internal resistance r connected to the network of resistors each of resistance r as shown in the figure. Obtain the expression for
(i) the current drawn from the cell and
(ii) the power consumed in the network. (Delhi 2016)



Question 128. (a) Draw a circuit diagram of a meter bridge used to determine the unknown resistance R of a given wire. Hence derive the expression for R in terms of the known resistance S.
(b) What does the term 'end error' in a metre bridge circuit mean and how is it corrected? How will the balancing point be affected, if the positions of the battery and galvanometer are interchanged in a metre bridge experiment? Give reason for your answer. (Comptt. Delhi 2016)

Question 129. (a) State the working principle of a potentiometer with help of a circuit diagram, explain how the internal resistance of a cell is determined.
(b) How are the following affected in the potentiometer circuit when
(i) the internal resistance of the driver cell increases and
(ii) the series resistor connected to the driver cell is reduced? Justify your answer. (Comptt. Delhi 2016)