CBSE 12th Physics
Unsolved Important Questions
Chapter 3

1 Mark Questions:

Q.1. State the reason, why GaAs is most commonly used in making of a solar cell.

Q.2. Two conducting wires X and Y of same diameter but different materials are joined in series across a battery. If the number density of electrons X is twice that in Y, find the ratio of drift velocity of electrons in the two wires.

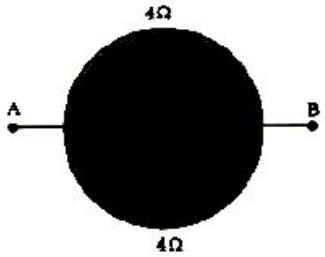
Q.3. Two wires of equal length, one of copper and the other of manganin have the same resistance. Which wire is thicker?

Q.4. Using the concept of force between two infinitely long parallel current carrying conductors, define one ampere of current.

Q.5. 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.

Q.6. A resistance R is connected across a cell of emf ε and internal resistance 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.

Q.7. A wire of resistance 8R is bent in the form of a circle. What is the effective resistance between the ends of a diameter AB?



Q.8. 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?

Q.9. Show a graph, the variation of resistivity with temperature for a typical semiconductor?

Q.10. A 10 V battery of negligible internal resistance is connected across a 200 V battery and a resistance of 38 Ω as shown in the figure. Find the value of the current in circuit.

Q.11. The emf of a cell is always greater than its terminal voltage. Why? Give reason.

Q.12. Define the term 'Mobility' of charge carriers in a conductor. Write its S.I. unit.

Q.13. Show variation of resistivity of copper as a function of temperature in a graph.

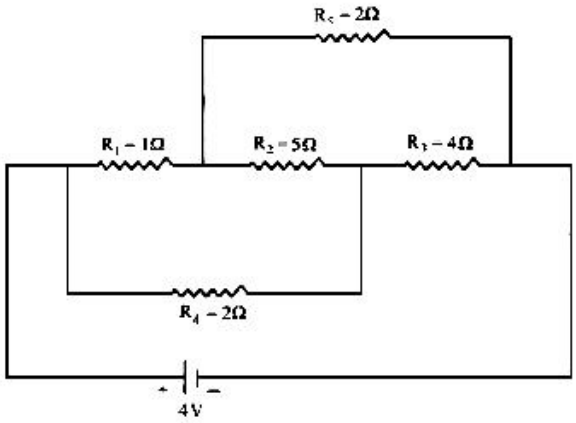
Q.14. A long straight current carrying wire passes normally through the center of circular loop. If the current through the wire increases, will there be an induced emf in the loop? Justify.

2 Mark Questions:

Q.15. 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 parallel. Compare the velocities of electrons in the two wires in both the cases (i) and (ii).

Q.16. Derive an expression for the resistivity of a good conductor, in terms of the relaxation time of electrons.

Q.17. Calculate the current drawn from the battery in the given network.



Q.18. How does the resistivity of a conductor depend upon temperature electrical conductivity?

Q.19. A wire of 15 ohm resistances 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 down from the battery.

Q.20. In the given circuit, assuming point A to be at zero potential, use Kirchhoff's rules to determine the potential at point B.

Q.21. 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?

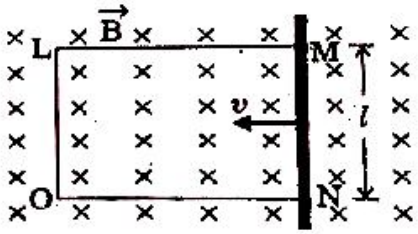
Q.22. A light bulb is rated 100 W for 220 V ac supply of 50 Hz. Calculate
(i) the resistance of the bulb;
(ii) the *rms* current through the blub.

Q.23. An alternating voltage given by V- 140 sin 314 is connected across a pure resistor of 50 Ω.Find
(i) the frequency of the source.
(ii) the rms current through the resistor.

Q.24. Explain the term 'drift velocity' in a conductor. Hence obtain the expression for the current through a conductor in terms of 'drift velocity'.

Q.25. Describe briefly, with the help of a circuit diagram, how a potentiometer is used to determine the internal resistance of a cell.

Q.26. A rectangular conductor LMNO is placed in a uniform magnetic field of 0.5T. The field is directed perpendicular to the plane of the conductor. When the arm MN of length of 20 cm is moved towards left with a velocity of $10 ms^{-1}$, calculate the emf induced in the arm. Given the resistance of the arm to be 5Ω (assuming that arms are of negligible resistance) find the value of the current in the arm.



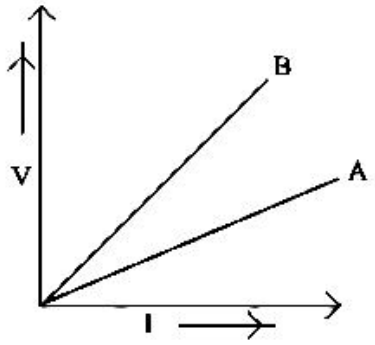
Q.27. A wheel with 8 metallic spokes each 50 cm long is rotated with a speed of 120 rev/min in a plane normal to the horizontal component of the Earth's magnetic field. The Earth's magnetic field at the place is 0.4 G and the angle of dip is 600. Calculate the emf induced between the axle and the rim of the number of spokes were increased?

Q.28. A cell of emf 'E' and internal resistance 'r' 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.

Q.29. Estimate the average drift speed of conduction electrons in a copper wire of cross-sectional area $1.0 \times 10^{-7}\ m^2$ carrying a current of 1.5×10^{-19} A. Assume the density of conduction electrons to be $9 \times 10^{28}\ m^{-3}$.

Q.30. Derive an expression for drift velocity of free electrons in a conductor in terms of relaxation time.

Q.31. V-1 Graph for parallel and series combination of two metallic resistors are shown in adjoining figure. Which graph represents parallel combination?



Q.32. A cell of *emf* E and internal resistance r is connected to two external resistances RI and R2 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 RI only

(iii) with RI and R2 in series combination

(iv) with RI and R2 in parallel combination

The currents measured in the four cases are 0.42 A, 1.05 A, 1.4 A and 4.2 A, but not necessarily in that order. Identify the currents corresponding to the four cases mentioned above.

Q.33. A metallic rod of 'L' length is rotated with angular frequency of 'w' with one end hinged at the center and the other end at the circumference of a circular metallic ring of radius L, about an axis passing through the center and perpendicular to the plane of the ring. A constant and uniform magnetic field B parallel to the axis is present everywhere. Deduce the expression for the emf between the center and the metallic ring.

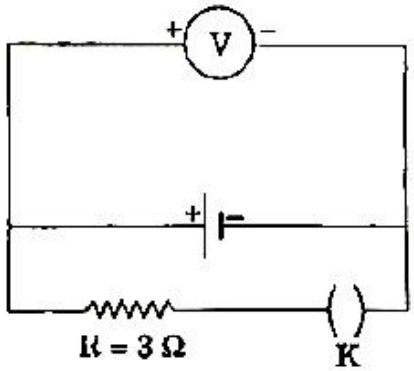
3 Mark Questions:

Q.34. (i) State the principle of working of a meter bridge.

(ii) In a meter bridge balance point is found at a distance *l* with resistance 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 a l_2 find the expression for X terms of l_1 $l_2$and S.

Q.35. 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, it 2. 2. V. When the terminals of the cell are also connected to a resistance of 5ohm as shown in the circuit, the voltmeter reading drops to 1. 8V. Find the internal resistance of the cell.



Q.36. State Kirchhoff's rules. Use these rules to write expressions for the currents I_i, $I_2$and I_3in the circuit diagram shown.

Q.37. Two heating elements of resistances R_1 and R_2 when operated at a constant supply of voltage, V, consume powers P_1 and P_2 respectively. Deduce the expressions for the power of their combination when they are, in turn, connected in (i) series and (ii) parallel across the same voltage supply.

Q.38. Define relaxation time of the free electrons drifting in 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.

Q.39. A wire AB is carrying steady current of 12 A and is lying on the table. Another wire CD carrying is held directly above AB at a height of 1 mm. Find the mass per unit length of the wire CD so that it remains suspended at its position when left free. Give the direction of the current flowing in CD with respect to that in AB. [Take the value of $g = 10\ ms^{-2}$].

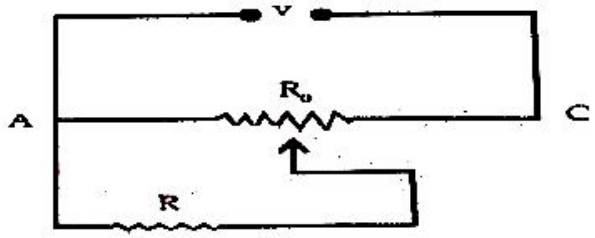
Q.40. Answer the following:

(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?

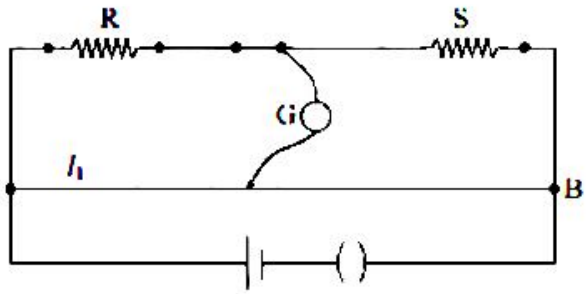
(c) Which material is used for the meter bridge wire and why.

Q.41. A resistance of R Ω draws current from a potentiometer, as shown in the figure. The potentiometer has a total resistance R_0 Ω. A voltage V is supplied to the potentiometer. Drive an expression for the voltage across R when the sliding contact is in the middle of the potentiometer.



Q.42. (a) Write the principle of working of a meter bridge.

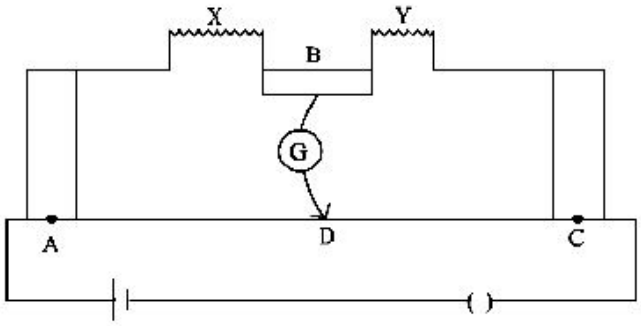
(b) In a meter bridge, the balance point is formed at a distance l_i with resistances R and S as shown in the figure



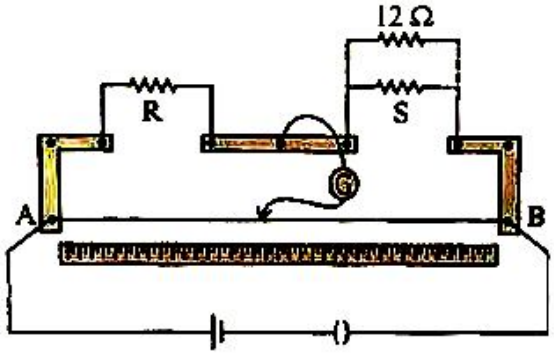
An unknown resistance X is now connected in parallel to the resistance S and the balance point is found at a distance l2. Obtain a formula for X in terms ofl_i, $l_2$and S.

Q.43. An air solenoid of length 0.3m, area of cross section is 1.2 x $10^{-3}m^2$and has 2500 turns. Around its central section, a coil of 350 turns is wound. The solenoid and the coil are electrically insulated from each other. Calculate the emf induced in the coil if the initial current of 3A in the solenoid is reversed in 0.25s.

Q.44. 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 40cm from the end A. When a resistance of 10Ω is conected. Q is connected in series with X, the null point shifts by 10 cm. Find the position of the null point when the 10Ω resistance is instead connected in series with. resistance 'Y'. Determine the values of the resistances X and Y.

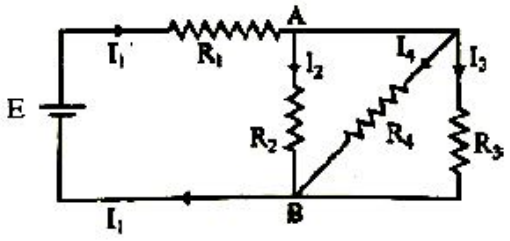


Q.45. In a meter bridge, the null point is found at a distance of 40 cm from A. If a resistance of 12 Ω is connected in parallel with S, the null point occurs at 50.0 cm from A. Determine the values of R and S.



Q.46. Define the terms (i) drift velocity, (ii) relaxation time.
A conductor of length L is connected to a dc source of emf ε. 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?

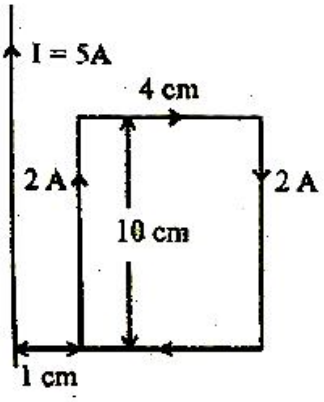
Q.47. In the circuit shown, $R_1 = 4\ \Omega$, $R_2 = R_3 = 15\ \Omega$, $R_1 = 30\ \Omega$ and E = 10 V. Calculate the equivalent resistance of the circuit and the current in each resistor.



Q.48. A rectangular loop of wire of size $4\ cm \times 10\ cm$ carries a steady current of 2A. A straight long wire carrying 5A current is kept near the loop as shown. If the loop and the wire are coplanar, find

(i) the torque acting on the loop.

(ii) the magnitude and direction of the force on the loop due to current carrying wire.

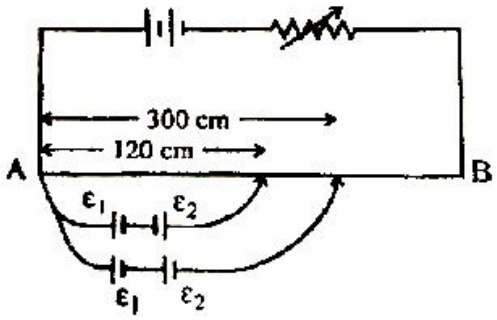


Q.49. In the figure a long uniform potentiometer wire AB is having a constant potential gradient along its length. The null points for the two primary cells of emf's ε_1 and ε_2 connected in the manner shown are obtained at a distance of 120cm and 300 cm from the end A. Find

(i) $\frac{\varepsilon_1}{\varepsilon_2}$

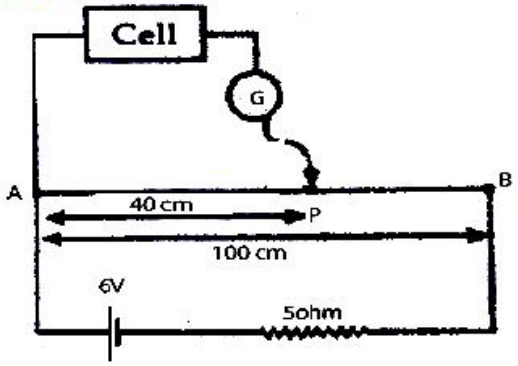
(ii) position of null point for the cell ε_1.

How is the sensitivity of a potentiometer is increased?

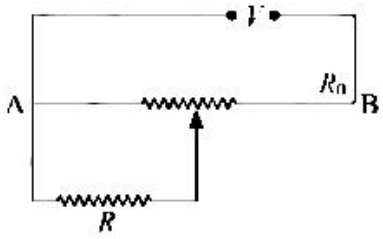


Q.50. Using Kirchhoff's rules determine the value of unknown registers R in the circuit so that no current flows through 4ohm resistance. Also find the potential difference between A and D.

Q.51. A potentiometer wire of length 1 m has a resistance of 10Ω. It is connected to a 6V battery in series with a resistance of 5Ω. Determine the emf of the primary cell which gives a balance point at 40cm.



Q.52. A resistance of R draws current from a potentiometer. The potentiometer wire, AB, has a total resistance of Ro. 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.



Q.53. (a) Define the term 'conductivity' of a metallic wire. Write its SI unit.

(b) Using the concept of free electrons in a conductor, derive the expression for the conductivity of a wire in terms of number density and relaxation time. Hence obtain the relation between current density and the applied electric field E.

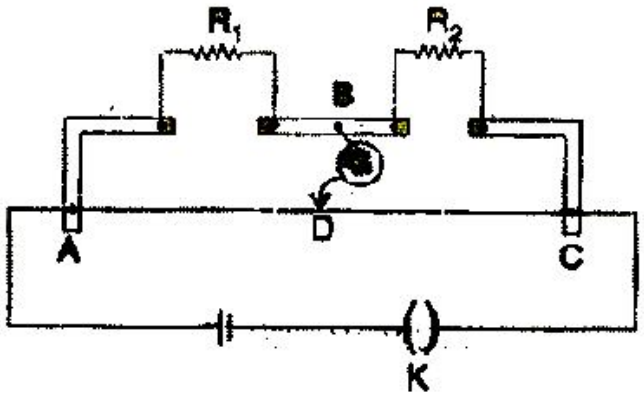
5 Marks Questions:

Q.54. (a) State the working principle of a potentiometer. With the help of the circuit diagram, explain how a potentiometer is used to compare the *emfs* 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.

Q.55. (a) State Kirchhoff's rules for an electric network. Using Kirchhoff's rules, obtain the balance condition in terms of the resistances of four arms of Wheatstone bridge.

(b) In the meter bridge experimental set up, shown in the figure, the null point 'D' is obtained at a distance of 40 cm from end A of the meter bridge wire. If a resistance of 10Ω is connected in series with R1, null point is obtained at AD=60 cm. Calculated the values of R1 and R2.



Q.56. (i) Derive an 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

Q.57. (i) State the two Kirchhoff's laws. Explain briefly how these rules are justified.

(ii) 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 draw from the cell and (ii) the power consumed in the network.

