current electricity-CBSE

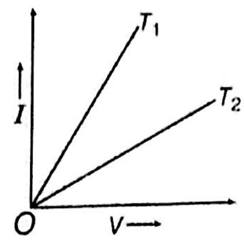
1 Mark Questions

1. How does the mobility of electrons in a conductor change, if the potential difference applied across the conductor is doubled, keeping the length and temperature of the conductor constant?

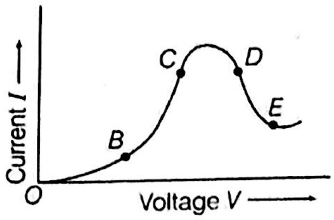
2. When a potential difference is applied across the ends of a conductor, how is the drift velocity of the electrons related to the relaxation time?

3. How is the drift velocity in a conductor affected with the rise in temperature?

4. I-V graph for a metallic wire at two different temperatures T_1 and T_2 is as shown in the figure below. Which of the two temperature is lower and why?



5. Graph showing the variation of current *versus* voltage for a material GaAs is shown in the figure. Identify the region



(i) of negative resistance.
(ii) where Ohm's law is obeyed.

6. Plot a graph showing the variation of resistivity of a conductor with temperature.

7. How does the random motion of free electrons in a conductor get affected when a potential difference is applied across its ends ?

8. Plot a graph showing variation of current *versus* voltage for the material GaAs.

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

10. Define the term drift velocity of charge carriers in a conductor and write its relationship with the current flowing through it.

11. Define the term electrical conductivity of a metallic wire. Write its SI unit.

12. Show variation of resistivity of Si with temperature in graph.

13. Define the term mobility of charge carriers in a conductor. Write its SI unit.

14. How does one explain increase in resistivity of a metal with increase of temperature ?

15. Write a relation between current and drift velocity of electrons in a conductor. Use this relation to explain how the resistance of a conductor changes with the rise in temperature?

16. Plot a graph showing the variation of resistance of a conducting wire as a function of its radius. Keeping the length of the wire and its temperature as constant.

17. Two materials Si and Cu, are cooled from 300 K to 60 K. What will be the effect on their resistivity?

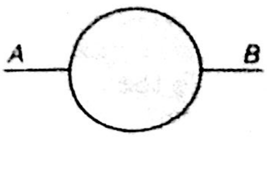
18. When electrons drift in a metal from lower to higher potential, does it mean that all the free electrons of the metal are moving in the same direction?

19. Show on a graph, the variation of resistivity with temperature for a typical semiconductor

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

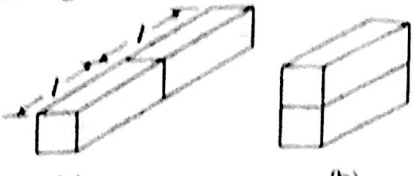
21. Define resistivity of a conductor. Write its SI unit.

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



23. 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 in X is twice than that in Y, then find the ratio of drift velocity of electrons in the two wires.

24. Two identical slabs, of a given metal, are joined together, in two different ways, as shown in figures (a) and (b).

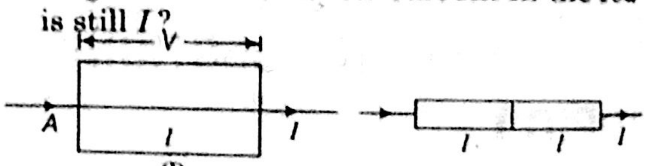


(a) (b)

What is the ratio of the resistances of these two combinations?

2 Marks Questions

25. A metal rod of square cross-sectional area A having length l has current I flowing through it when a potential difference of V volt is applied across its ends (figure I). Now the rod is cut parallel to its length into two identical pieces and joined as shown in figure II. What potential difference must be maintained across the length of $2l$ so that the current in the rod is still I?



(I) (II)

26. Using the concept of drift velocity of charge carriers in a conductor, deduce the relationship between current density and resistivity of the conductor.

27. 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 A. Assume the density of conduction electrons to be $9 \times 10^{28} m^{-3}$.

Or 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}.

Or 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}.

28. 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?

29. Derive an expression for the current density of a conductor in terms of the drift speed of electrons.

30. Define mobility of a charge carrier. Write the relation expressing mobility in terms of relaxation time. Give its SI unit.

31. A conductor of length l is connected to a DC source of potential V. If the length of the conductor is tripled by gradually stretching it, keeping V constant, how will
(i) drift speed of electrons and
(ii) resistance of the conductor be affected? Justify your answer.

32. (i) You are required to select a carbon resistor of resistance $47\,k\Omega \pm 10\%$ from a large collection. What should be the sequence of colour bands used to code it ?
(ii) Write the characteristics of manganin which make it suitable for making standard resistance.

33. Plot a graph showing temperature dependence of resistivity for a typical semiconductor. How is this behaviour explained?

34. The sequence of coloured bands in two carbon resistors R_1 and R_2 is
(i) brown, green, blue and
(ii) orange, black, green.
Find the ratio of their resistances.

3 Marks Questions

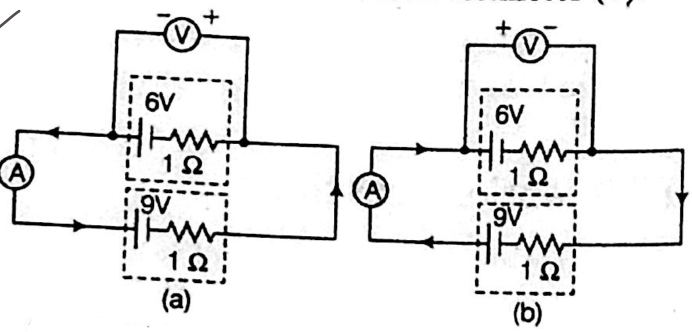
35. Show on a plot, variation of resistivity of (i) a conductor and (ii) a typical semiconductor as a function of temperature.
Using the expression for the resistivity in terms of number density and relaxation time between the collisions, explain how resistivity in the case of a conductor increases while it decreases in a semiconductor, with the rise of temperature.

36. (i) Define the term conductivity of a metallic wire. Write its SI unit.
(ii) 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.

37. (i) Define the term of 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?

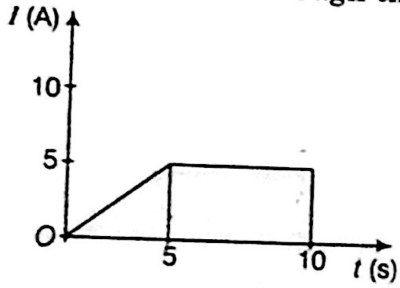
38. Find the relation between drift velocity and relaxation time of charge carriers in a conductor. A conductor of length L is connected to a DC source of emf E. If the length of the conductor is tripled by stretching it, keeping E constant, explain how its drift velocity would be affected.

39. In the two electric circuits shown in the figure, determine the readings of ideal ammeter (A) and the ideal voltmeter (V).



40. (i) Deduce the relation between current I flowing through a conductor and drift velocity v_d of the electrons.

(ii) Figure shows a plot of current I flowing through the cross-section of a wire *versus* the time t. Use the plot to find the charge flowing in 10 through the wire.

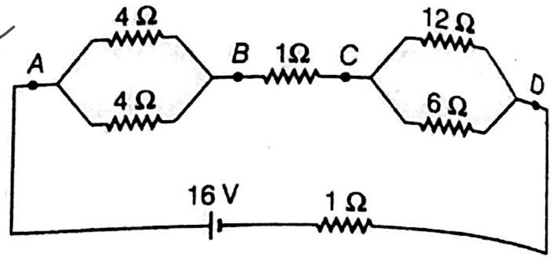


41. Define relaxation time of the free electrons drifting in a conductor. How it is related to the drift velocity of free electrons? Use this relation to deduce the expression for the electrical resistivity of the material.

42. (i) Derive the relation between current density J and potential difference V across a current carrying conductor of length l, area of cross-section A and the number density n of free electrons.

(ii) 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 A. [Assume that the number density of conduction electrons is $9 \times 10^{28}\ m^{-3}$]

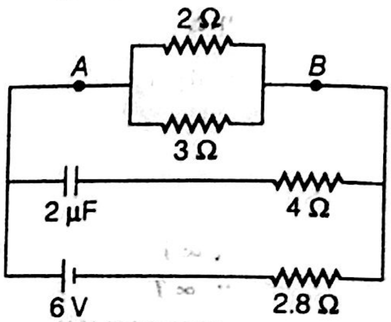
43. A network of resistors is connected to a 16 V battery of internal resistance of 1 Ω as shown in the figure.



(i) Compute the equivalent resistance of the network.

(ii) Obtain the voltage drops V_{AB} and V_{CD}.

44. Calculate the steady current through the 2Ω resistor in the circuit shown in the figure.



5 Marks Question

45. (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

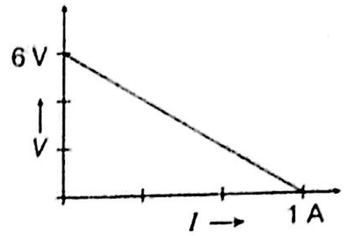
(c) Electric current

(d) Electric field

Justify your answer.

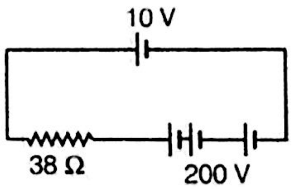
1 Mark Questions

1. The plot of the variation of potential difference across a combination of three identical cells in series *versus* current is shown below. What is the emf and internal resistance of each cell?



2. 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?

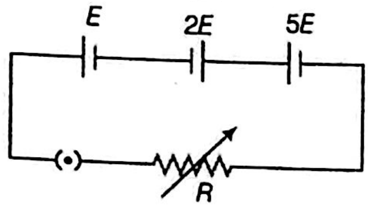
3. A 10 V battery of negligible internal resistance is connected across a 200 V battery and a resistance of 38 Ω as shown in the figure. Find the value of the current in circuit.



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

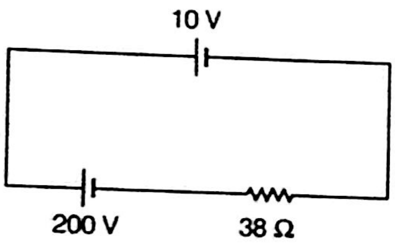
5. A cell of emf E and internal resistance r draws a current I. Write the relation between terminal voltage V in terms of E, I and r.

6. Three cells of emf $E, 2E$ and $5E$ having internal resistances $r, 2r$ and $3r$ respectively are connected across a variable resistance R as shown in the figure. Find the expression for the current. Plot a graph for variation of current with R.

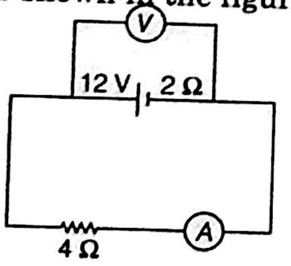


2 Marks Questions

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



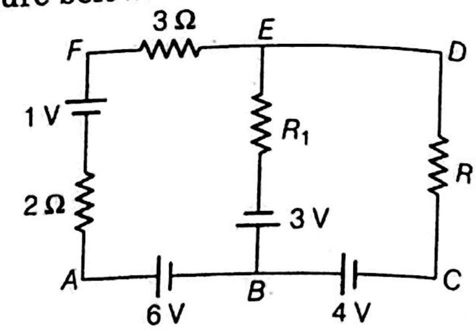
8. A battery of emf 12 V and internal resistance 2 Ω is connected to a 4 Ω resistor as shown in the figure.



(i) Show that a voltmeter when placed across the cell and across the resistor, in turn, gives the same reading.

(ii) To record the voltage and the current in the circuit, why is voltmeter placed in parallel and ammeter in series in the circuit?

9. 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 below:

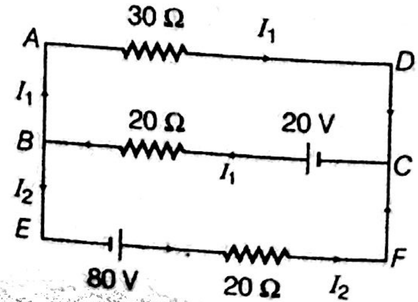


10. Two cells of emfs 1.5 V and 2.0 V having internal resistances 0.2 Ω and 0.3 Ω respectively are connected in parallel. Calculate the emf and internal resistance of the equivalent cell.

11. 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 the emf of the cell and its internal resistance can be determined.

12. 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) *versus* the current (I) drawn from the cell. Using this plot, show how does one can determine the internal resistance of the cell?

13. Use Kirchhoff's rules to determine the value of the current I_1 flowing in the circuit shown in the figure.



14. A battery of emf E and internal resistance r when connected across an external resistance of 12 Ω, produces a current of 0.5 A. When connected across a resistance of 25 Ω, it produces a current of 0.25 A. Determine (i) the emf and (ii) the internal resistance of the cell.

15. 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_1 only

(iii) With R_1 and R_2 in series combination

(iv) With R_1 and R_2 in parallel combination

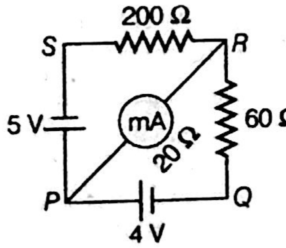
The currents measured in the four cases are 0.42 A, 1.05 A, 1.4 A and 4.2 A, but not necessarily in that order. Identify the currents corresponding to the four cases mentioned above.

16. A battery of emf 10 V and internal resistance 3 Ω is connected to a resistor. If the current in the circuit is 0.5 A, find

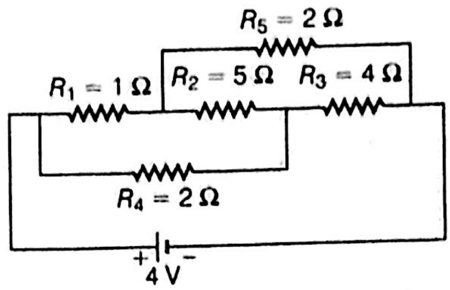
(i) the resistance of the resistor.

(ii) the terminal voltage of the battery.

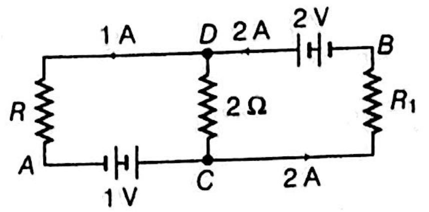
17. The network $PQRS$, shown in the circuit diagram, has the batteries of 4 V and 5 V and negligible internal resistance. A milliammeter of 20 Ω resistance is connected between P and R. Calculate the reading in the milliammeter.



18. Calculate the current drawn from the battery in the given network.



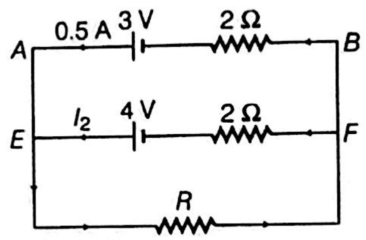
19. In the given circuit, assuming point A to be at zero potential, use Kirchhoff's rules to determine the potential at point B.



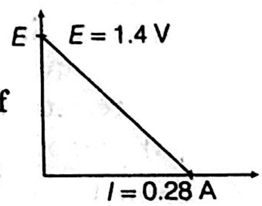
20. Using Kirchhoff's rules in the given circuit, determine

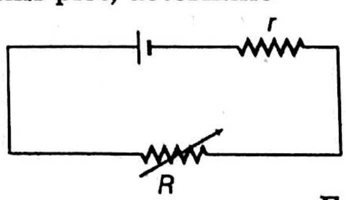
(i) the current I_2 in the arm EF.

(ii) the voltage drop across the unknown resistor R and



21. A straight line plot showing the terminal potential difference (V) of a cell as a function of current (I) drawn from it is shown in the figure. Using this plot, determine



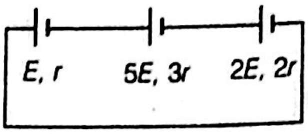


Current in circuit, $i = \dfrac{E}{R + r}$

(i) the emf and
(ii) internal resistance of the cell.

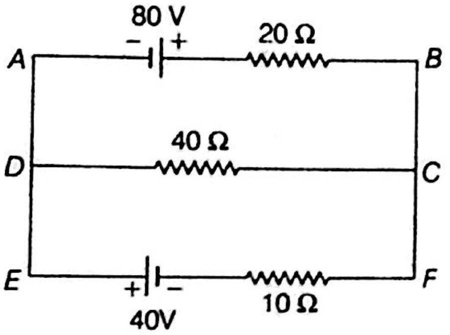
22. Two cells of emf $2E$ and E and internal resistances $2r$ and r respectively, are connected in parallel. Obtain the expressions for the equivalent emf and the internal resistance of the combination.

23. Three cells of emf $E, 2E$ and $5E$ having internal resistances r, $2r$ and $3r$, variable resistance R as shown in the figure. Find the expression for the current. Plot a graph for variation of current with R.



3 Marks Questions

24. Using Kirchhoff's rules, calculate the current through the 40 Ω and 20 Ω resistors in the following circuit.

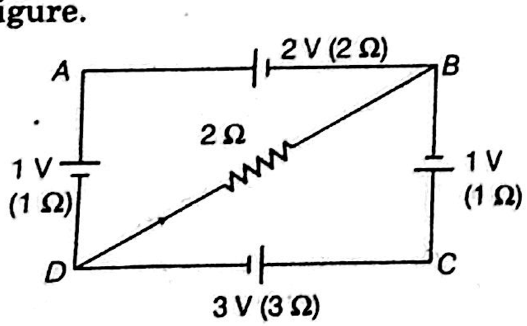


25. Two cells of emfs ε_1 and ε_2 and internal resistances r_1 and r_2 respectively are connected in parallel. Obtain expressions for the equivalent.

(i) resistance and

(ii) emf of the combination

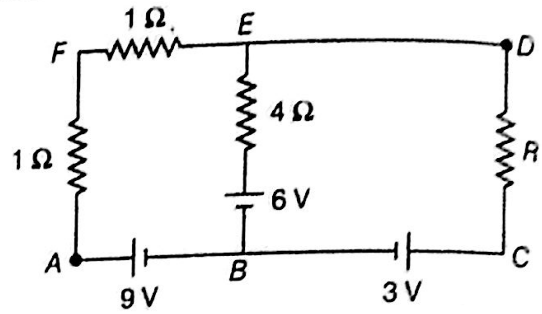
26. Using Kirchoff's rules calculate the potential difference between B and D in the circuit diagram as shown in the figure.



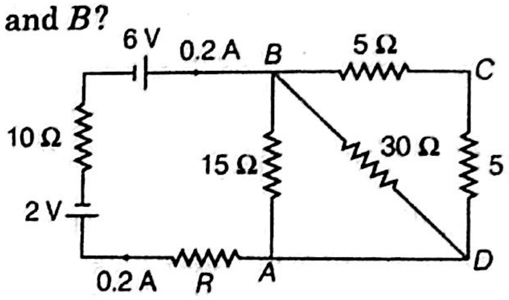
27. A cell of emf E and internal resistance r is connected across a variable load resistor R. Draw the plots of the terminal voltage V *versus* (i) resistance R and (ii) current I.

It is found that when $R = 4\ \Omega$, 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.

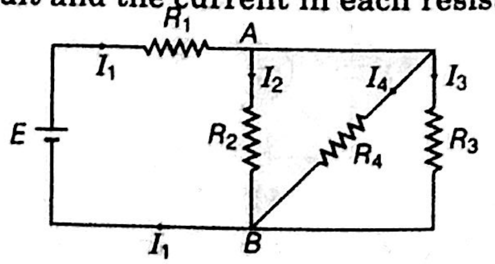
28. Using Kirchhoff's rules, determine the value of unknown resistance R in the circuit, so that no current flows through 4 Ω resistance. Also, find the potential difference between points A and D.



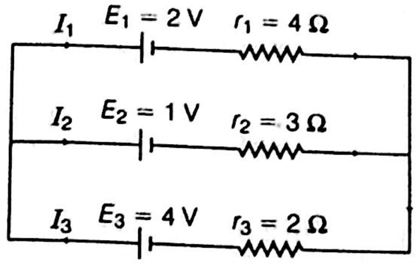
29. Calculate the value of the resistance R in the circuit shown in the figure, so that the current in the circuit is 0.2A. What would be the potential difference between points A and B?



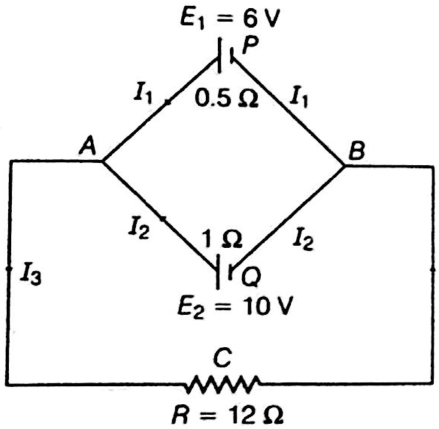
30. In the circuit shown, $R_1 = 4\ \Omega$, $R_2 = R_3 = 15\ \Omega$, $R_4 = 30\ \Omega$ and $E = 10$ V. Calculate the equivalent resistance of the circuit and the current in each resistor.



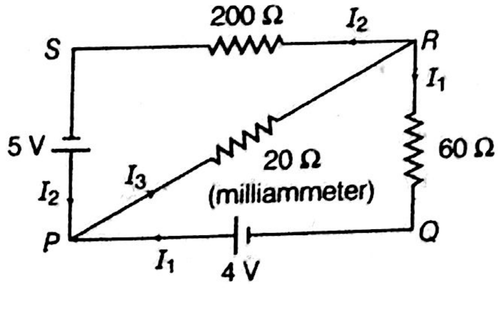
31. State Kirchhoff's rules. Use these rules to write the expressions for the currents I_1, I_2 and I_3 in the circuit diagram shown in figure below.



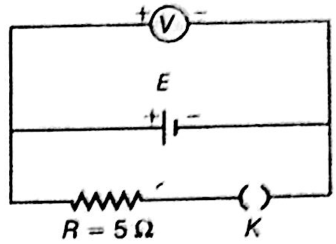
32. State Kirchhoff's rules. Apply Kirchhoff's rules to the loops *ACBPA* and *ACBQA* to write the expressions for the currents I_1, I_2 and I_3 in the network.



33. State Kirchhoff's rules. Apply these rules to the loops *PRSP* and *PRQP* to write the expressions for the currents I_1, I_2 and I_3 in given circuit.



34. 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.



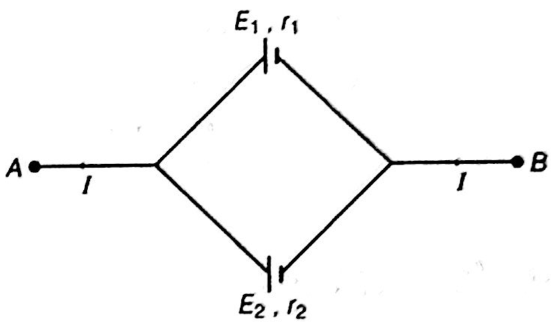
35. (i) State Kirchhoff's rules.

(ii) A battery of 10 V and negligible internal resistance is connected across the diagonally opposite corners of a cubical network consisting of 12 resistors each of 1 Ω resistance. Use Kirchhoff's rules to determine

(a) the equivalent resistance of the network and

(b) the total current in the network.

36. Two cells of emf E_1, E_2 and internal resistances r_1 and r_2 respectively are connected in parallel as shown in the figure.



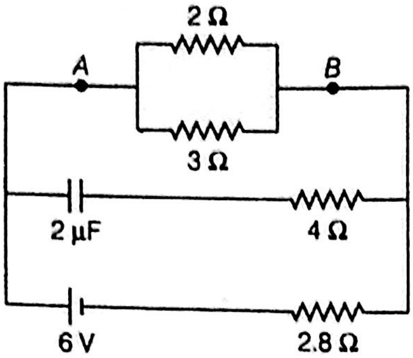
Deduce the expressions for

(i) the equivalent emf of the combination.

(ii) the equivalent resistance of the combination and

(iii) the potential difference between the points *A* and *B*.

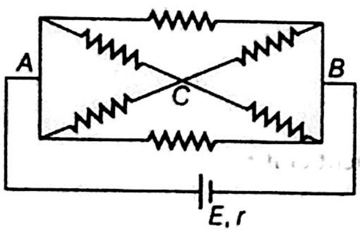
37. Calculate the steady current through the $2\,\Omega$ resistor in the circuit shown in the figure below.



5 Marks Question

38. (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
(a) the current draws from the cell and
(b) the power consumed in the network.



1 Mark Questions

1. 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.

2. State the underlying principle of a potentiometer?

3. A heating element is marked 210 V, 630 W. What is the value of the current drawn by the element when connected to a 210 V DC source?

4. A resistance R is connected across a cell of emf E and internal resistance r. Now, a potentiometer measures the potential difference between the terminals of the cells as V. Write the expression for r in terms of E, V and R.

5. In an experiment on meter bridge, if the balancing length AC is X, what would be its value, when the radius of the meter bridge wire AB is doubled? Justify your answer.

6. In a meter bridge, two unknown resistances R and S when connected in the two gaps, give a null point at 40 cm from one end. What is the ratio of R and S?

2 Marks Questions

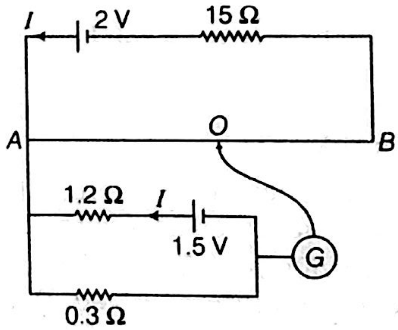
7. Two bulbs are rated (P_1, V) and (P_2, V). If they are connected (i) in series and (ii) in parallel across a supply V, find the power dissipated in the two combinations in terms of P_1 and P_2.

8. Two electric bulbs P and Q have their resistances in the ratio of 1 : 2. They are connected in series across a battery. Find the ratio of the power dissipation in these bulbs.

9. In a potentiometer arrangement for determining the emf of a cell, the balance point of the cell in open circuit is 350 cm. When a resistance of 9 Ω is used in the external circuit of the cell, the balance point shifts to 300 cm. Determine the internal resistance of the cell.

10. Use Kirchhoff's rules to obtain balance conditions for the balance conditions in a Wheatstone bridge.

11. (i) State the principle of working of a potentiometer.
    (ii) In the following potentiometer, circuit AB is a uniform wire of length 1 m and resistance 10 Ω. Calculate the potential gradient along the wire and balance length AO (l).

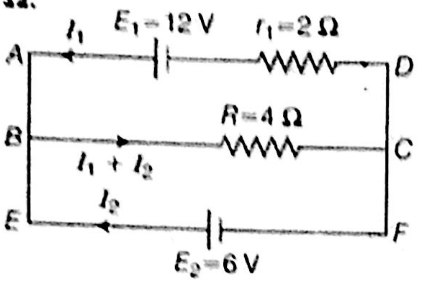


12. A potentiometer wire of length 1 m has a resistance of 10 Ω is supplied a constant voltage of 6 V. Determine the emf of the primary cell which gives a balance point at 40 cm.

Or 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.

Or 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.

13. In the electric network shown in the figure, use Kirchhoff's rules to calculate the power consumed by the resistance $R = 4\,\Omega$.



14. An ammeter of resistance 0.80 Ω can measure current up to 1.0 A.

(i) What must be the value of shunt resistance to enable the ammeter to measure current up to 5.0 A ?

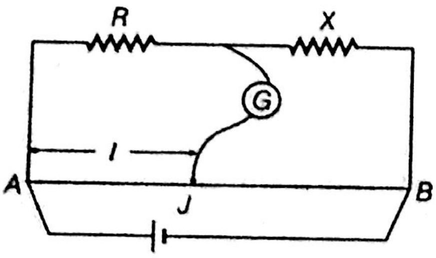
(ii) What is the combined resistance of the ammeter and the shunt?

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

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

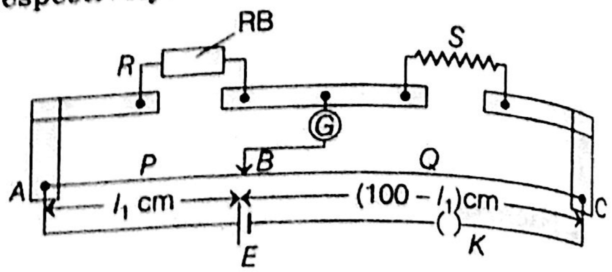
(i) The values of R and X were doubled and then interchanged. What would be the new position of balance point?

(ii) If the galvanometer and battery are interchanged at the balanced position, how will the balance point get affected?



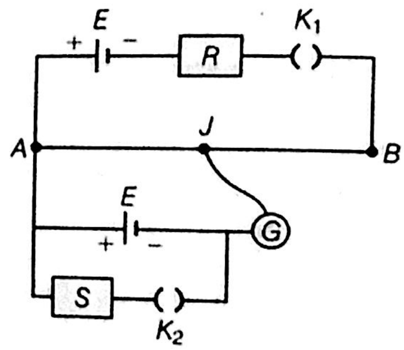
3 Marks Questions

17. What is end error in a meter bridge ? How is it overcome ? The resistance in the two arms of the meter bridge are $R = 5\Omega$ and S respectively.



When the resistance S is shunted with an equal resistance, the new balance length found to be $1.5\,l_1$, where l_1 is the initial balancing length, Calcuate the value of S.

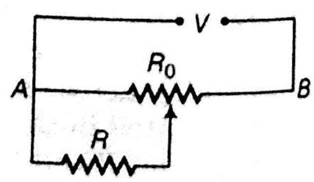
18. Two students X and Y perform an experiment on potentiometer separately using the circuit given below. Keeping other parameters unchanged, how will the position of the null point be affected, if



(i) X increases the value of resistance R in the set up by keeping the key K_1 closed and the key K_2 open?

(ii) Y decreases the value of resistance S in the set up, while the key K_2 remains open and then K_1 closed? Justify your answer.

19. A resistance of R draws current from a potentiometer. The potentiometer wire AB, has a total resistance of R_0. A



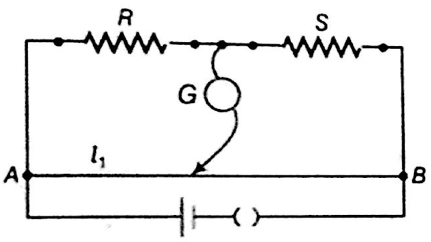
voltage V is supplied to the potentiometer. Derive an expression for the voltage across R, when the sliding contact is in the middle of potentiometer wire.

20. (i) 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?

(ii) In the figure shown, an ammeter A and a resistor of 4 Ω are connected to the terminals of the source. The emf of the source is 12 V having an internal resistance of 2 Ω. Calculate the voltmeter and ammeter readings.

21. (i) Write the principle of working of a metre bridge.

(ii) In a metre bridge, the balance point is found at a distance l_1 with resistance 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.

22. Answer the following:

(i) Why are the connections between the resistor in a meter bridge made of thick copper strips?

(ii) Why is it generally preferred to obtain the balance point in the middle of the meter bridge wire?

(iii) Which material is used for the meter bridge wire and why?

23. (i) State the underlying principle of a potentiometer. Why is it necessary to

(a) use a long wire,

(b) have uniform area of cross-section of the wire and

(c) use a driving cell whose emf is taken to be greater than the emfs of the primary cells?

(ii) 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.

24. 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 E_1 and E_2 connected in the manner shown, are obtained at a distance of 120 cm and 300 cm from the end A.

Find

(i) E_1/E_2 and

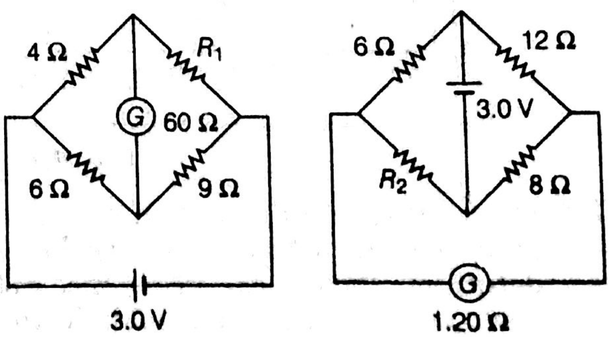
(ii) position of null point for the cell E_1.

How is the sensitivity of a potentiometer increased?

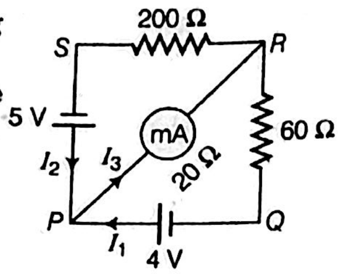
25. Define the current sensitivity of a galvanometer. Write its SI unit.

Figure shows two circuits each having a galvanometer and a battery of 3 V.

When the galvanometer in each arrangement do not show any deflection, obtain the ratio R_1/R_2.



26. 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?

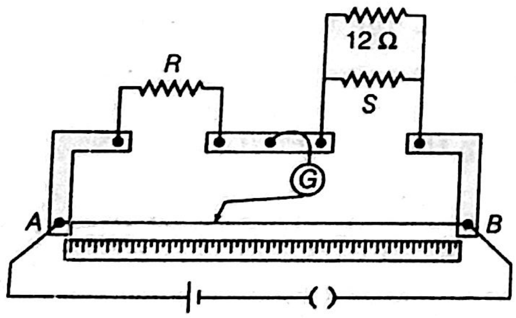
27. With the help of circuit diagram, explain how a potentiometer can be used to compare emf of two primary cells?

28. 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

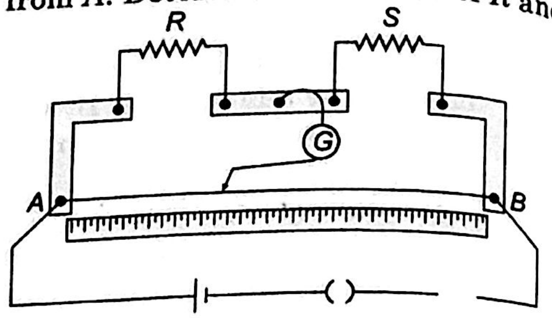
(ii) parallel across their same voltage supply.

29. 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*, then null point occurs at 50.0 cm from *A*. Determine the values of *R* and *S*.

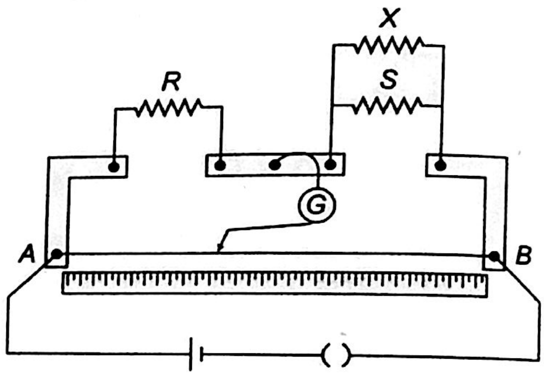


30. Draw the circuit diagram of a potentiometer which can be used to determine the internal resistance *r* of a given cell of emf *E* and explain it. How can we increase the sensitivity of a potentiometer?

31. In a meter bridge, the null point is found at a distance of 60 cm from *A*. If a resistance of 5 Ω is connected in series with *S*, then null point occurs at 50.0 cm from *A*. Determine the values of *R* and *S*.



32. In a meter bridge, the null point is found at a distance of l_1 cm from *A*. If a resistance of *X* is connected in parallel with *S*, then null point occurs at a distance l_2 cm from *A*. Obtain the formula for *X* in terms of l_1, l_2 and *S*.

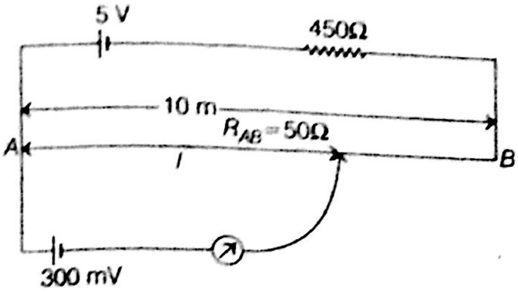


5 Marks Questions

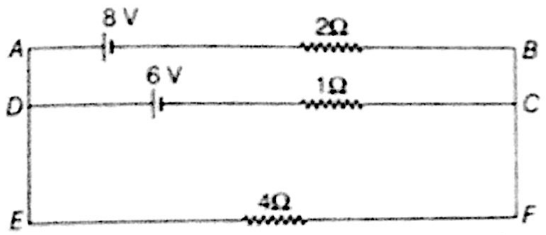
33. (a) Describe briefly, with the help of a circuit diagram, the method of measuring the internal resistance of a cell.

(b) Give reason why a potentiometer is preferred over a voltmeter for the measurement of emf of a cell.

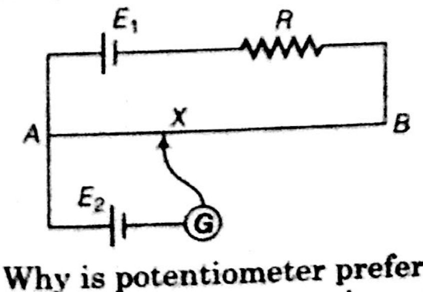
(c) In the potentiometer circuit given below, calculate the balancing length *l*. Give reason, whether the circuit will work, if the driver cell of emf 5 V is replaced with a cell of 2 V, keeping all other factors constant.



34. (a) State the working principle of a meter bridge used to measure an unknown resistance.
(b) Give reason
(i) why the connections between the resistors in a metre bridge are made of thick copper strips.
(ii) why is it generally preferred to obtain the balance length near the mid-point of the bridge wire.
(c) Calculate the potential difference across the 4Ω resistor in the given electrical circuit, using Kirchhoff's rules.



35. (i) In the circuit diagram given below AB is a uniform wire of resistance 15 Ω and length 1 m is connected to a cell E_1 of emf 2V and negligible internal resistance and a resistance R. The balance point with another cell E_2 of emf 75 mV is found at 30 cm from end A. Calculate the value of R.

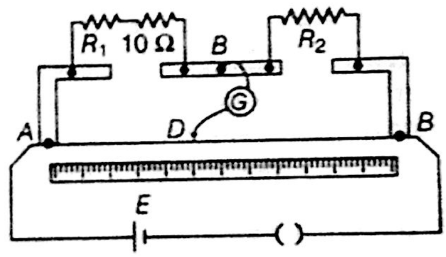


(ii) Why is potentiometer preferred over a voltmeter for comparison of emf of cells ?

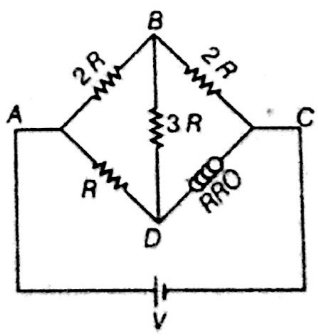
(iii) Draw a circuit diagram to determine internal resistance of a cell in the laboratory.

36. (i) 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.
(ii) Write two possible causes for one sided deflection in a potentiometer experiment.

37. (i) 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.
(ii) 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 10 Ω is connected in series with R_1, null point is obtained at AD = 60 cm. Calculate the values of R_1 and R_2.



38. (i) Use Kirchhoff's rules to obtain the balance condition in a Wheatstone bridge.



(ii) Calculate the value of R in the balance condition of the Wheatstone bridge, if the carbon resistor connected across the arm CD has the colour sequence red, red and orange, as shown in the figure.

(iii) If now the resistance of the arms BC and CD are interchanged, to obtain the balance condition, another carbon resistor is connected in place or R. What would now be sequence of colour bands of the carbon resistor?

39. (i) State the working principle of a potentiometer. Draw a circuit diagram to compare emf of two primary cells. Derive the formula used.

(ii) Which material is used for potentiometer wire and why?

(iii) How can the sensitivity of a potentiometer be increased ?

40. (i) State with the help of a circuit diagram, the working principle of a meter bridge. Obtain the expression used for determining the unknown resistance.

(ii) What happens if the galvanometer and cell are interchanged at the balance point of the bridge?

(iii) Why is it considered important to obtain the balance point near the mid-point of the wire?

Objective Questions

(For Complete Chapter)

1 Mark Questions

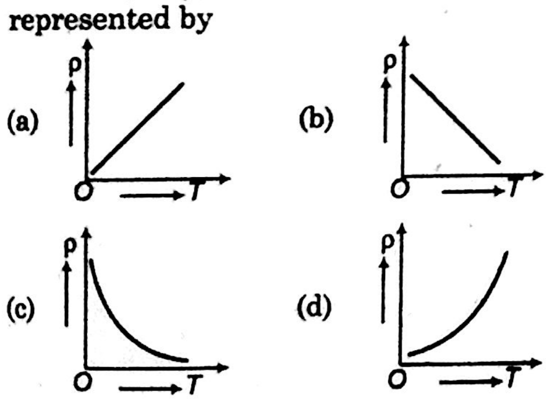
1. The dimensions of mobility of charge carriers are
(a) $[M^{-2}T^2A]$ (b) $[M^{-1}T^2A]$
(c) $[M^{-2}T^3A]$ (d) $[M^{-1}T^3A]$
(e) $[M^{-1}T^3A^{-1}]$

2. The temperature coefficient of resistance of an alloy used for making resistors is
(a) small and positive
(b) small and negative
(c) large and positive
(d) large and negative
(e) zero

3. A 220 V main supply is connected to a resistance of 100 k Ω. The effective current is
(a) 2.2 mA (b) $2.2\sqrt{2}$ mA
(c) $\frac{2.2}{\sqrt{2}}$ mA (d) None of these

4. The resistance of the fuse wire is
(a) low (b) moderate
(c) zero (d) very high

5. The temperature (T) dependence of resistivity (ρ) of a semiconductor is represented by

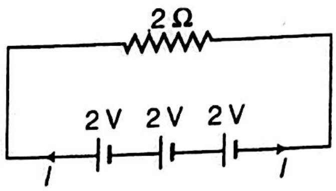


6. The resistance of a wire is 24 Ω. It is so stretched that the length becomes four times, then the new resistance of wire will be
(a) 248 Ω (b) 298 Ω (c) 384 Ω (d) 428 Ω

7. The unit of specific conductivity is
(a) Ω-cm^{-1} (b) Ω-cm^{-2} (c) Ω^{-1}cm (d) $\Omega^{-1}cm^{-1}$

8. A uniform wire of resistance 9 Ω is joined end-to-end to form a circle. Then, the resistance of the circular wire between any two diametrically opposite points is
(a) 6 Ω (b) 3 Ω (c) $\frac{9}{4}$ Ω (d) $\frac{3}{2}$ Ω
(e) 1 Ω

9. In the electric circuit shown, each cell has an emf of 2 V and internal resistance is 1 Ω. The external resistance is 2 Ω. The value of the current I is (in ampere)

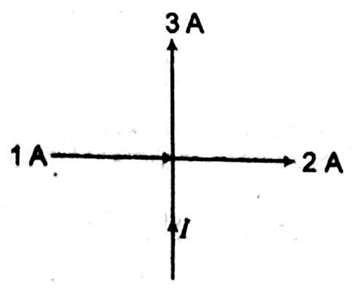


(a) 2 (b) 1.25
(c) 0.4 (d) 1.2

10. Two batteries of emfs 2 V and 1 V of internal resistances 1 Ω and 2 Ω respectively are connected in parallel. The effective emf of the combination is
(a) $\frac{3}{2}$ V (b) $\frac{5}{3}$ V (c) $\frac{3}{5}$ V (d) 2 V
(e) 5 V

11. Current provided by a battery is maximum when
(a) internal resistance is equal to external resistance
(b) internal resistance is greater than external resistance
(c) internal resistance is less than external resistance
(d) None of the above

12. The value of current I in figure is



(a) 4 A (b) 6 A (c) 3 A (d) 5 A