PHYSICS

BOOKS - NEW JYOTHI PHYSICS (TAMIL ENGLISH)

CURRENT ELECTRICITY

Solved Problems

1. In the bhohr model of H-atoms,the electrons moves in a circular orbit of radius 0.53 Å with

speed of $2.65 \times 10^6 m/s$. Calculate the current orbit.

Watch Video Solution

2. (a) Esttimate the average drift speed of conduction electrons in a copper wite of cross-secttonal area $1.0 \times 10^{-7} m^2$ carrying a current of $1.5A$. Assume the each copper atom contrbutes roughly one conduction electron. The density of copper is $9.0 \times 10^3 kg/m^3$, and its atomic mass is

$63.5u$. (b) Compare the drift speed obyained above with, (1) thermal speeds of copper atoms at ordinary temperaturtes. (ii) speed of propagation of electric field along the conductor which causes the drift motion.

Watch Video Solution

3. (a) In the above example, the electron drift speed is estimated to be only a few mm s^{-1} for currents in the range of a few amperes, How then is current established almost the

instant a circuit is closed?

(b)The electron drift arises due to the force experienced by electrons in the electric fieldinside the conductor. But force should cause acceleration. Why then do the electrons acquire a steady average drift speed?

If the electron drift speed is so small, and the electron's charge is small, how can we still obtain large amounts of current in a conductor?

(d)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?

(e) Are the paths of electrons straight lines between successive collisions (with the positive ions of the metal) in the (i) absence of electric field, (ii) presence of electric field?

View Text Solution

4. A wire of resistance 4Ω is drawn (a) to twice its original length, (b) by twice its original length. Calculate the new resistance in each case.

View Text Solution

5. A copper wire is stretched to make it 0.1% longer .What is the percentage increase In resistance?

Watch Video Solution

6. Calculate the length of an aluminium wire of diameter 0.5 mm required to have a resistance of3Ω at $20^\circ C$ .Rresisitvity of aluminium is $2.8 \times 10^{-8}\Omega m$

Watch Video Solution

7. The value of a resistor is 10 mega ohm with tolerance 10%. Colour code the resistor.

Watch Video Solution

8. An electric toaster uses nichrome for its heating element. When a negligibly small current passes through it, its resistance at room temperature $(27.0^{\circ}C)$ is found to be

75.3Ω. When the toaster is connected to a 230 V supply, the current settles, after a few seconds, to a steady value of 2.68 A. What is the steady temperature of the nichrome element? The temperature coefficient of resistance of nichrome averaged over the temperature range involved, is $1.70 \times 10^{-4} \circ C^{-1}$

View Text Solution

9. The resistance of the platinum wire of a platinum resistance thermometer at the ice point is 5Ω and at steam point is 5.23Ω. When the thermometer is inserted in a hot bath, the resistance of the platinum wire is 5.795Ω. Calculate the temperature of the bath.

View Text Solution

10. In discharge tube the number of hydrogen ions (i.e.,protons)drifting across a cross

section per second is 1.0×10^{18}, while the number of electrons difrition is the opposite direction across - section is 3.7×10^{18} per second .If the supply vptage is 2 effective of the tube?

View Text Solution

11. A carbon resistor has coloured rings in the order Red, Red, Orange and Gold. Compute the resistance value.

Watch Video Solution

12. Two coils have a combined resistance of 9Ω when connected in series and 2Ω when connected in parallel. Find the resistance of each coil.

Watch Video Solution

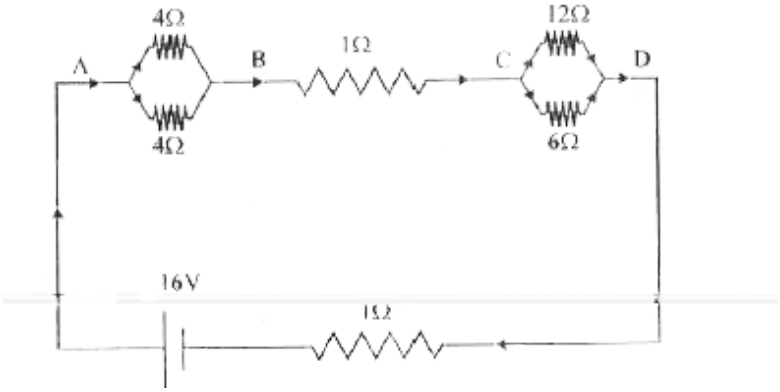
13. A network of resistors is connected to a 16 V battery with internal resistance of 1Ω, as shown in figure.

a. Compute the equivalent resistance of the

network.

b. Obtain the current in each resistor.

Obtain the voltage drops $V_{AB} V_{BC}$ and V_{CD}



View Text Solution

14. Compute the internal resistance of an electrical generator which has an emf of 230 V

and a terminal voltage of 210 V when supplying 20 A current.

Watch Video Solution

15. Six lead acid secondaryt celle each ofemf 2Vand-internal resistanee 0.015Ω joined in series to provide a supply to a resistance of 8.5 Ω. Find the current drawn from the battery and its terminal voltage.

Watch Video Solution

16. A cell has an emf of 1.5V and an internal resistance 1Ω. It is connected to two resistances 2Ω and 3Ω in series. Find (a) the current flowing in the circuit, and (b) potential difference across the ends of each resistance.

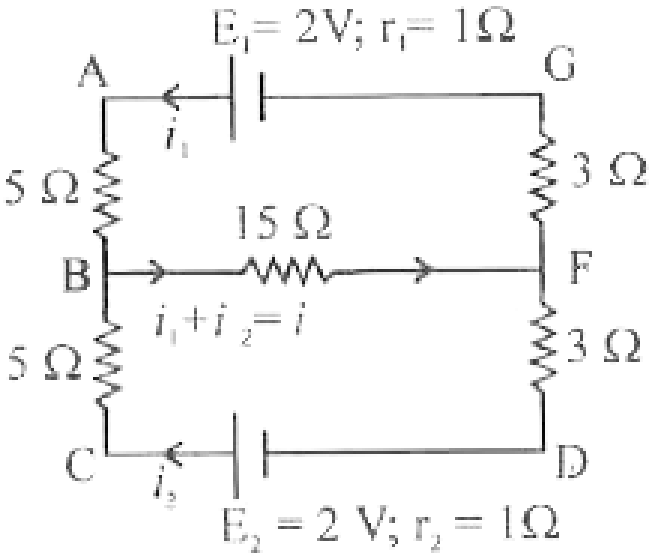
Watch Video Solution

17. A 6V battery of internal resistance 1Ω and a 12V battery of internal resistance 2Ω. are joined in parallel. The combination sends a

current through an external resistance 18Ω. Find the current sent by each battery.

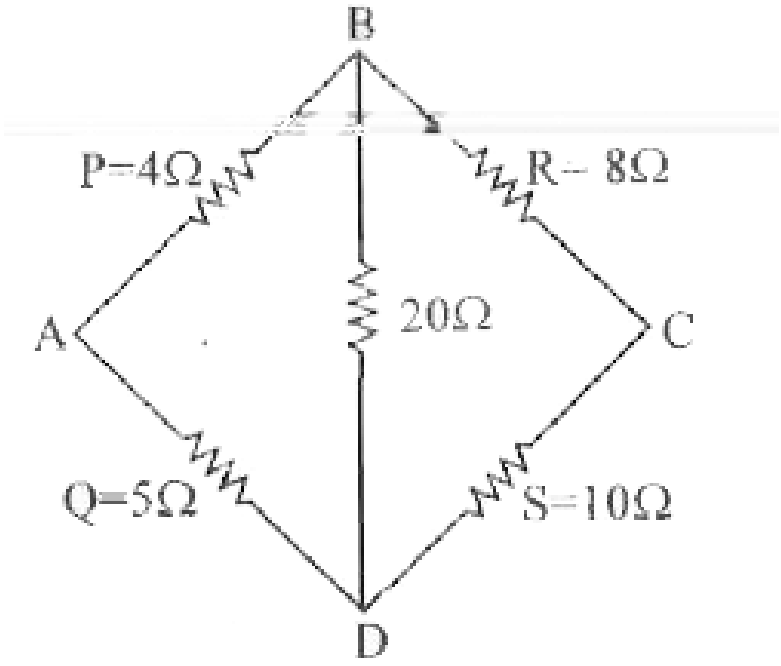
View Text Solution

18. Compute the currents in each branch of the given circuit.



View Text Solution

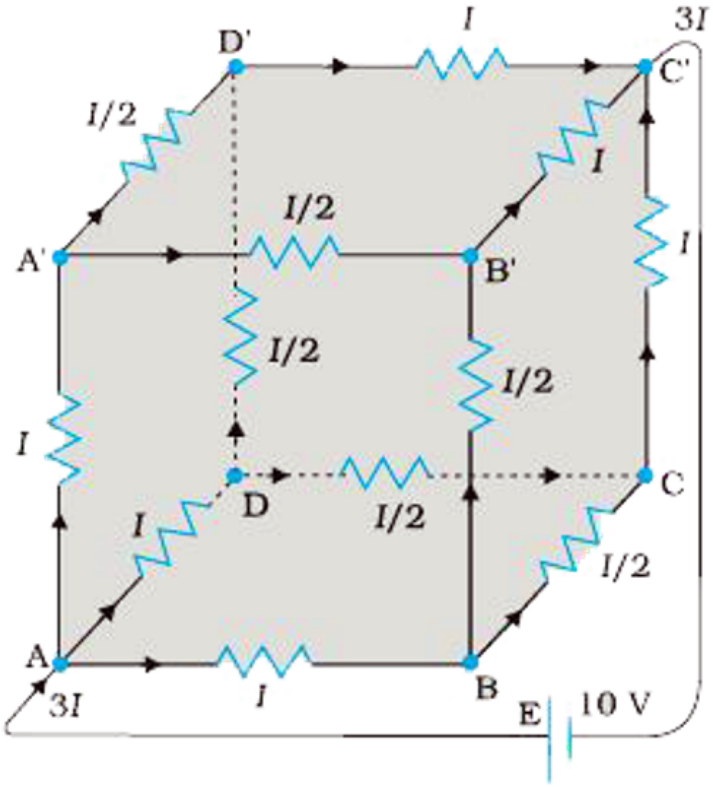
19. Find the effective resistance between A and C.



View Text Solution

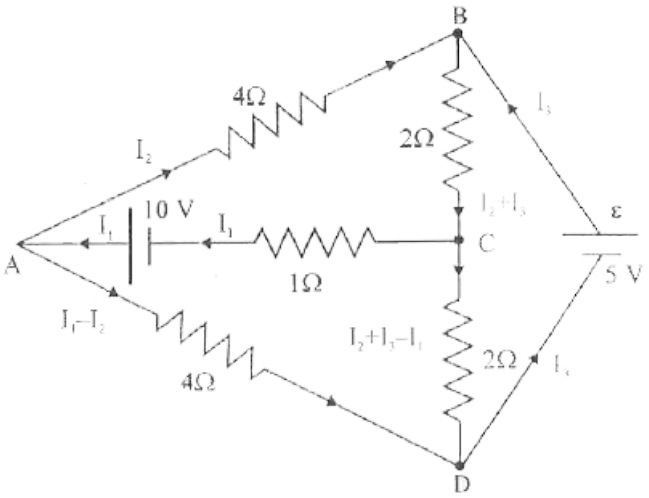
20. A bettery of 10 V and negligible internal resistance is connected across the diagonally opposite corners of a cubical network consisting of 12 resistors each of resistance 1Ω Determine the equivalent resistance of the network and the current along each edge of

the cube.



Watch Video Solution

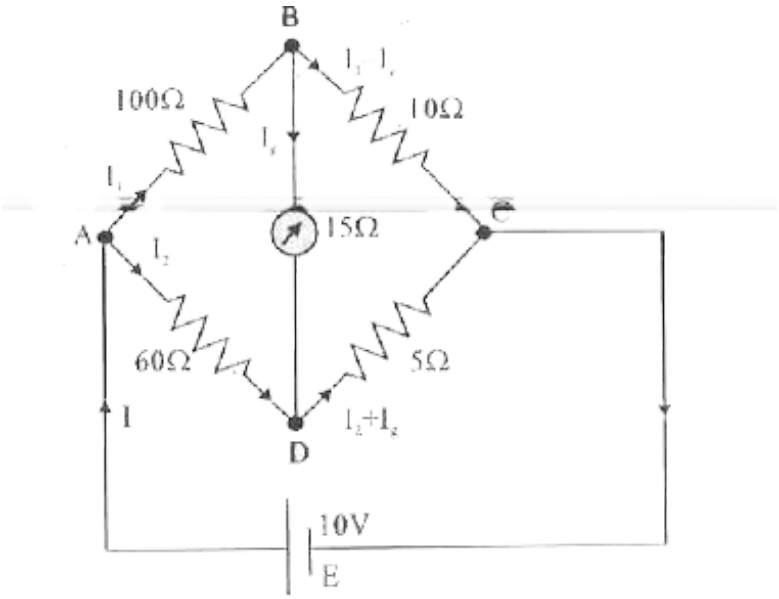
21. Determine the current in each branch of the network shown in figure.



View Text Solution

22. The four arms of a Wheatstone bridge have the following resistances: AB = 100Ω, BC = 10Ω

, CD = 5Ω, and DA = 60 Ω,



A galvanometer of 15Ω resistance is connected across BD. Calculate the current through the galvanometer when a potential difference of 10V is maintained across AC

View Text Solution

23. In a metre bridge, the null point is found at a distance of 33.7 cm from A. If now a resistance of 12Ω is connected in parallel with S, the null point occurs at 51.9 cm. Determine the values of R and S.

View Text Solution

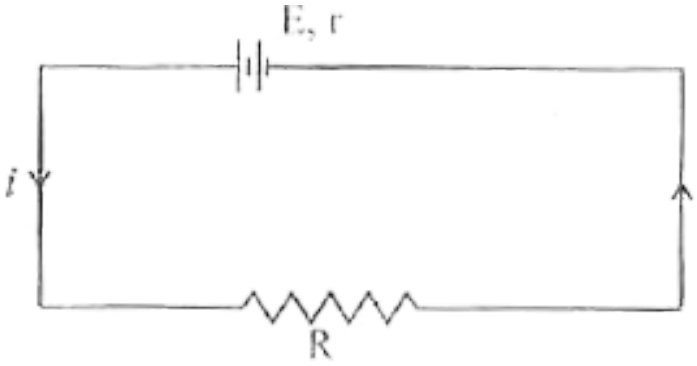
24. A rsisitance of $R\Omega$ draws current from a potentiometer. Te potentiometer has a total resistance $R_0\Omega$ A voltage V is supplited to the potentiometer. Derive an expression for the

voltage across R when the sliding contact is in the middle of the potenttometer.

Watch Video Solution

25. In the circuit given below a current of 0.8 A flows through the external resistance when R= 10Ω and 0.4A when R = 25.Ω. Calculate the

internal resistance and e.m.f. of the battery.



Watch Video Solution

26. A potentiometer wire has a length 400 cm and a resistance of 20Ω. It is connected in series with an external resistance R and a cell of e.m.f. 1.5 V and internal resistance 1Ω. A source of e.m.f.6 mV is balanced against a

length of 30 cm of the potentiometer wire. Find R. According to the principle of potentiometer $V \propto l$.

i.e., V = ilp where l'is the balancing length & p the resistance per cm of the potentiometer wire.

Watch Video Solution

27. A two volt battery of internal resistance one ohm is connected in series with a potentiometer wire of length 800 cm and a

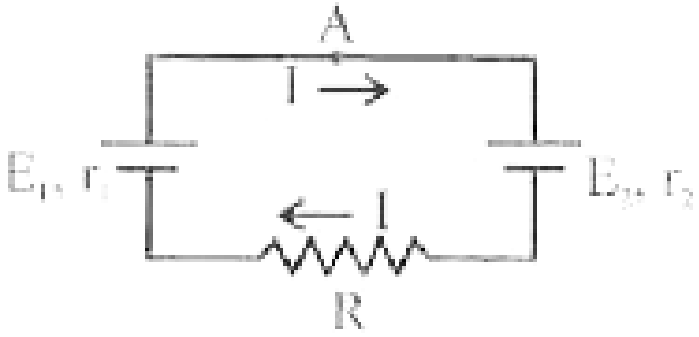
resistance of 16Ω and an external resistance 3 Ω. Find the p.d. per cm of the wire.

View Text Solution

28. In the determination of internal resistance of a cell of e.in.f. 1.5 V with potentiometer, the balancing length is 75 cm in the open circuit and when a resistance of 10Ω is used the balancing length is found to be 65 cm. Calculate the internal resistance of the cell.

Watch Video Solution

29. Calculate the current in the following



circuit.

E_1= 4.5 V, E_2= 3V, r_1, = 39, r_2, = 20, R=15Ω

View Text Solution

Solution To Exercises From Ncert Text

1. The storage battery of a car has an emf of 12 V.if the internal resistance of the battery is 0.4 Ω,what is the maximum current that can be drawn from the battery>

Watch Video Solution

2. A battery of emf 10Vand internal resistance 3Ω is connected to a resistor.If the current in the circuit is 0.5A, what is the resistance of the

resistor ? What is the terminal voltage ot the battery when the circuit is clossed ?

Watch Video Solution

3. (a)Three resistors $1\Omega, 2\Omega$ and 3Ω are combined in series. What is the total resistance of the combination?

(b). If the combination is connected to a battery of emf 12 V and negligible internal resistance, obtain the potential drop across each resistor.

Watch Video Solution

4. a.Three resistors $2\Omega, 4\Omega$ and 5Ω are combined in parallel. What is the total resistance of the combination?

b. If the combination is connected to a battery of emf 20 V and negligible internal resistance, determine the current through each resistor and the total current drawn from the battery.

Watch Video Solution

5. At room temperature $(27.0^{\circ}C)$ the resistance of a heating element is 100Ω. What is the temperature of the element if the resistance is found to be 117Ω. Given that the temperature coefficient of the material of the resistor is $1.70 \times 10 - 4^{\circ}C$.

Watch Video Solution

6. A negligible small current is pass through a wire of length 15m and uniform cross section

$6 \times 10^{-7} m^2$ and its resistance is measured to be 5Ω. What is the resistivity of the material at the temperature of the experiment ?

Watch Video Solution

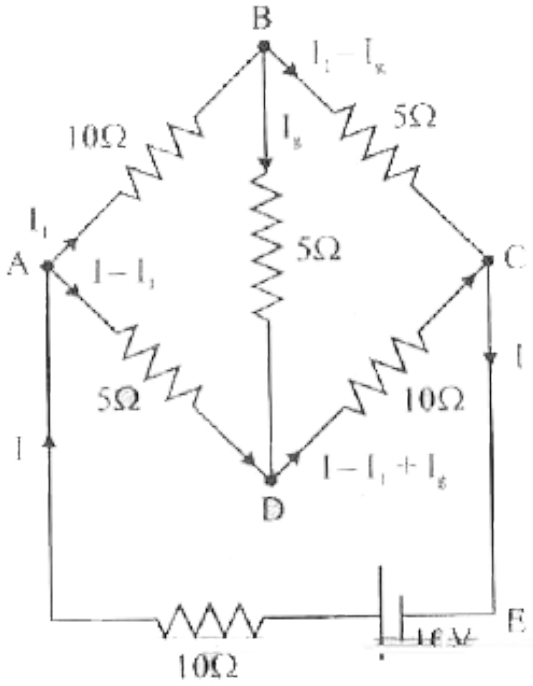
7. A silver wire has a resistance of $2.1\Omega 27.5^\circ C\Omega$ and a resistance of $2.7\Omega \text{at} 100^\circ C$. Determinethe temperature co-efficient of resistance of the silver.

Watch Video Solution

8. A heating element using nichrome connected to a 230V supply draws an initial current of 3.2 A which settles after a few seconds to steady value of 2.8 A. What is the steady temperature of the heating element if room temperature is $27.0^{\circ}C$? Temperature coefficient of resistance of nichrome averaged over the temperature range involved is $1.70 \times 10_{-4}$

Watch Video Solution

9. Determine the current in each branch of the network shown in Fig.



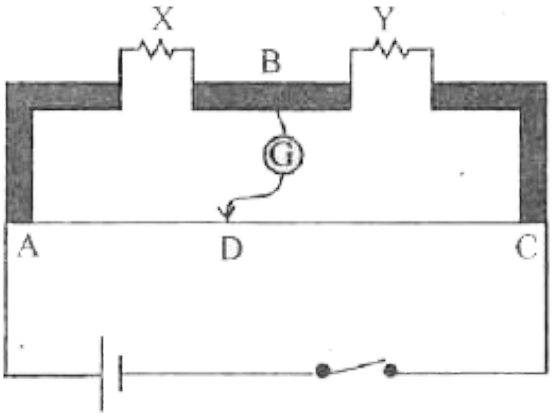
View Text Solution

10. a. In a metre bridge the balance point is found to be at 39.5 cm from the end A, when the resistor Y is of 12.5Ω. Determine the resistance of X. Why are the connections between resistors in a Wheatstone or meter bridge made of thick copper strips?

b. Determine the balance point of the bridge if X and Y are interchanged.

c. What happens if the galvanometer and cell are interchanged at the balance point of the

bridge? Would the galvanometer show any current?



View Text Solution

11. A storage battery of emf 8.0 V and internal resistance 0.5Ω is being charged by a 120 V de supply using a series resistor of 15.5Ω. What is the terminal voltage of the battery during

charging? What is the purpose of having a series resistor in the charging circuit?

Watch Video Solution

12. In a potentiometer arrangement a cell of emf 1.25 V givesn a balance point at 35 cm length of the wire. If the cell is replaced by another cell and the balance point shift to 63 cm, what is the emf of the second cell ?

Watch Video Solution

13. The number density of free electrons in a copper conductor is $8.5 \times 10^{28} m^{-3}$. How long does an electron take to drift from one end of a wire of 3.0 m long to its other end? The area of cross-section of the wire is $2.0 \times 10^{-6} m^2$ and it is carrying a current of 3.0 A.

Watch Video Solution

14. The earth's surface has a negative surface charge of $10^{-9} Cm^{-2}$. The potential

difference of 400 kV between the top of the atmosphere and the surface results (due to the low conductivity of the lower atmosphere) in a current of only 1800 A over the entire globe. If there were no mechanism of sustaining atmospheric electric field, how much time (roughly) would be required to neutralise the earth's surface? (This never happens in practice because there is a mechanism to replenish electric charges, namely the contínal understorms and lihgtningin curent parts of the globe. (Radiu of each $6.37 \times 10^6 m$)

View Text Solution

15. a. Six lead-acid type of secondary cells each of emf 2.0 V and internal resistance 0.015Ω are joined in series to provide a supply to a resistance of 8.5Ω. What are the current drawn from the supply and its terminal voltage?

b. A secondary cell after long use has an emg of 1.9 V and a large internal resistance of 380Ω . What maximum current can be drawn from the cell? Could the cell drive the starting motor of a car?

View Text Solution

16. Two wires of equal length, one of aluminium and the other of copper have the same resistance. Which of the two wires is lighter? Hence explain why aluminium wires are preferred for overhead power cables. `(P_(Al) = 2.63xx 10^(-8)Omegam, P_(au) = 1.72 10^(-8)Omegam, Relative density of Al = 2.7 and that of Cu = 8.9.)

View Text Solution

17. What conclusion can you draw from the follwing observation on a resistor made of alloy manganin ? `

`

Watch Video Solution

18. Answer the following questions.

a. A steady current flows in a metallic conductor of non-uniform cross-section. Which of these quantities is constant along

the conductor current, current density, electric field, drift speed?

b. Is Ohm's law universally applicable for all conducting elements? If not, give examples of elements which do not obey Ohm's law.

c. A low voltage supply from which one needs high currents must have very low internal resistance. Why?

d. A high tension (HT) supply of, say, 6 kV must have a very large internal resistance. Why?

View Text Solution

19. Choose the correct alternative:

a. Alloys of metals usually have (greater/less) resistivity than that of their constituent metals.

b. Alloys usually have much (lower/higher) temperature coefficient of resistance than pure metals.

c. The resistivity of the alloy manganin is nearly independent of increases rapidly with increase of temperature.

d. The resistivity of a typical insulator (e.g., amber) is greater than that of a metal by a factor of the order of $\left(10^{22}/10^{3}\right)$.

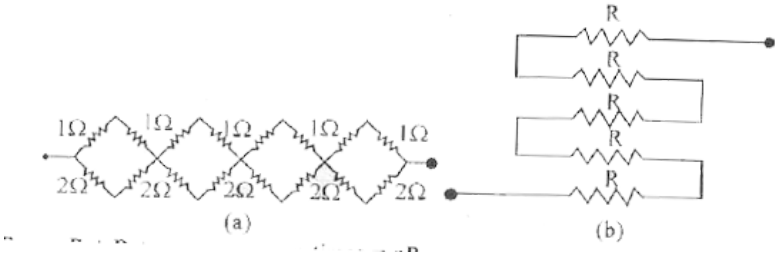
View Text Solution

20. a. Given n resistors each of resistance R. How will you combine them to get the (1) maximum (ii) minimum effective resistance? What is the ratio of the maximum to minimum effective resistance?

b. Given the resistances of 1Ω, 2Ω, 3Ω. . How will you combine them to get an equivalent resistance of (i) (11/3) Ω(ii) (11/5)Ω, (iii) 6Ω, (iv) (6/11) Ω?

c. Determine the equivalent resistance of

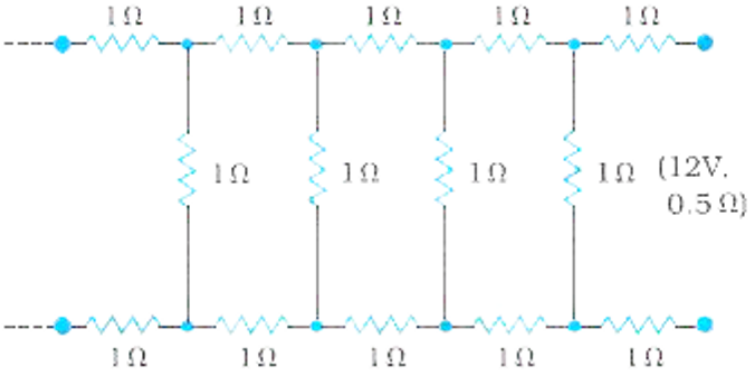
networks shown in the figure.



View Text Solution

21. Determine the furrent drawn from a 12 V suly with internal resistacne 0.5Ω by the infinite network shown in Each rsistor has 1Ω

resistance.



Watch Video Solution

22. Figure shows a potentiometer with a cell of 2.0 V and internal resistance 0.402 main taining a potential drop across the resistor wire AB. A standard cell which maintains a constant emf of 1.02 V (for very moderate

currents upto a few mA) gives a balance point at 67.3 cm length of the wire. To ensure very low currents drawn from the standard cell, a very high resistance of 600 k Ω is put in series with it, which is shorted close to the bal- ance point. The standard cell is then replaced by a cell of unknown emf and the balance point is found similarly, turns out to be at 82.3 cm length of the wire.

a. What is the value &?

b. What purpose does the high resistance of 600 kΩ have?

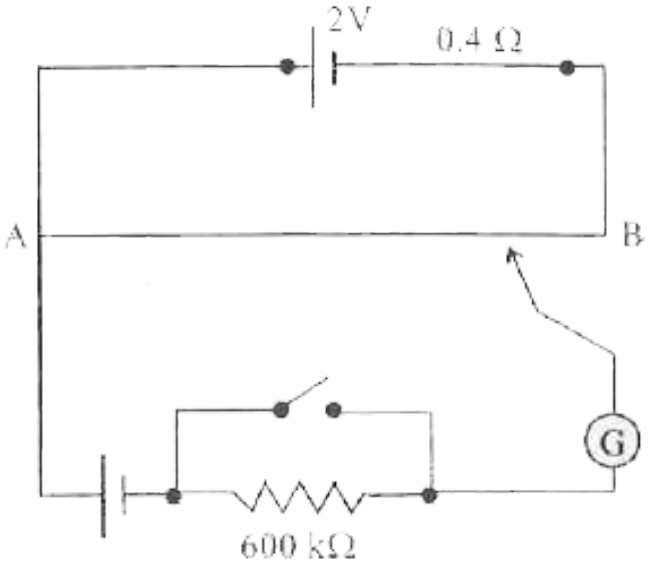
c. Is the balance point affected by this high

600 kg resistance?

d. Is the balance point affected by the internal resistance of the driver cell?

e. Would the method work in the above situation if the driver cell of the potentiometer had an emf of 1.0V instead of 2.0V? f. Would the circuit work well for determining an extremely small emf, say of the order of a few mV (such as the typical emf of a thermo-couple)? If not, how will you modify

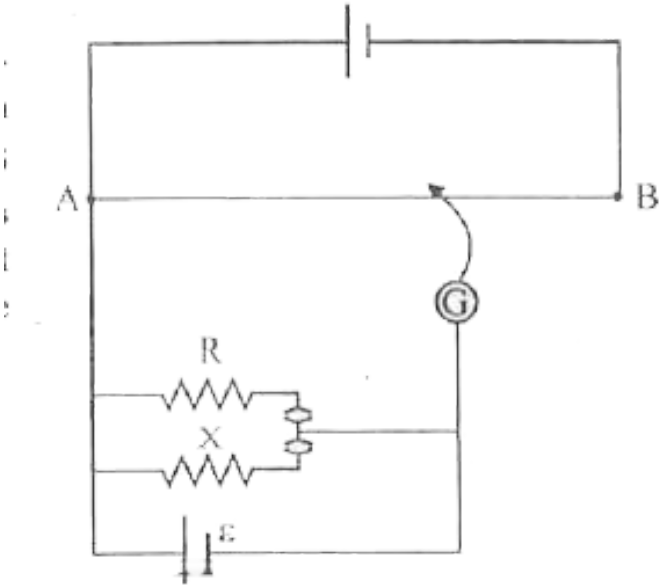
the circuit?



View Text Solution

23. Figure shows a potentiometer circuit for comparison of two resistances. The balance point with a standard resistor R = 10.0Ωis

found to be 58.3 cm, while that with the unknown resistance X is 68.5 cm. Determine the value of X. What might you do if you failed to find a balance point with the given cell of

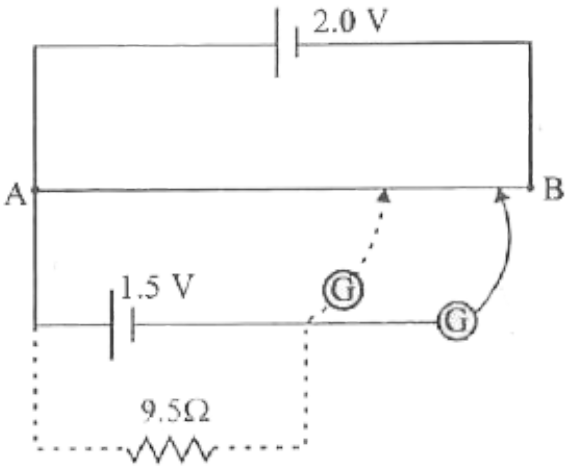


emf ε ?

View Text Solution

24. Figure shows a 2.0 V potentiometer used for the determination of internal resistance of a 1.5 V cell. The balance point of the cell in open circuit is 76.3 cm. When a resistor of 9.5Ω is used in the external circuit of the cell, the balance point shifts to 64.8 cm length of the potentiometer wire. Determine the internal

resistance of the cell



Watch Video Solution

Practice Problems For Self Assessment

1. The density of electrons in copper is $8.4 \times 10^{22} per cm^3$? Calculate the drift velocity of electrons in a copper wire of $2mm^2$- area of cross section and carries a current of 0.15 A.

Watch Video Solution

2. A uniform wire of length / and radius r has a resistance of 25Ω. It is melted and drawn into a thin wire of (a) length 2l, (b) radius $\frac{r}{2}$. Calculate the new resistance in each case,

Watch Video Solution

3. A 100gm piece of aluminium is drawn into a wire of 0.2 mm thick and another piece into 0.3 mm thick. Compare their resistances.

View Text Solution

4. A platinum wire has a resistance of 10Ω at $C30^{\circ}$ and 30Ω in a hot furnace. Find the temperature of the hot furnace. Given

$$\propto = 36 \times 10^{-4} c(-1)$$

Watch Video Solution

5. Give the colour code of the resistor of resistance $470\Omega \pm = 10\,\%$ tolerance.

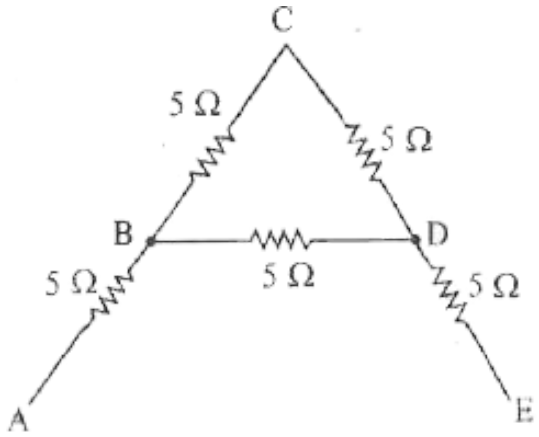
Watch Video Solution

6. The sequence of bands marked on a carbon resistor is in the order brown, brown, green. What is the resistance value?

Watch Video Solution

7. A 3Ω resistance is connected in parallel to an unknown resistance to give the equivalent resis- tance of 2Ω. Find the value of the unknown resistance

View Text Solution



8. Find the equivalent resistance of the given network between A & E.

View Text Solution

9. Three resistors each of resistance $4\Omega, 8\Omega$ and 1Ω are connected in series. A p.d.

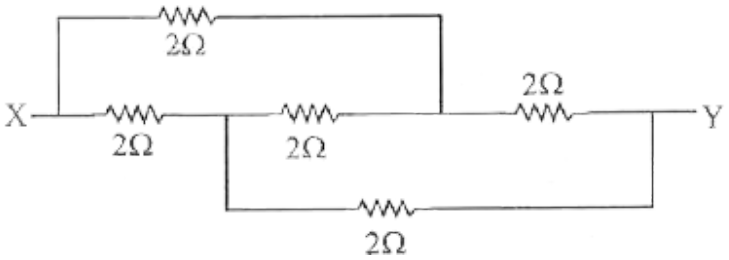
of 240 V is applied across the combination. Find the total current and p.d. across each resistor.

View Text Solution

10. Two resistors of resistances 5Ω and 1Ω are put in parallel. A cellofe.m.f. 1.5 V is connected to the combination. Find the current through each resistor.

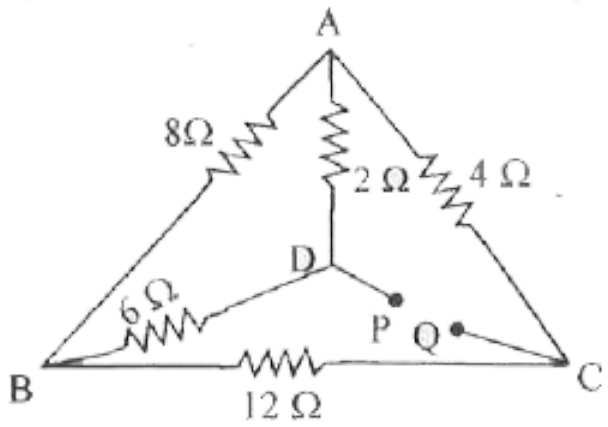
View Text Solution

11. Calculate the equivalent resistance between X and Y of the following network.



View Text Solution

12. Find the effective resistance between P & Q of the following network.



View Text Solution

13. You are given two resistors. By using-singly, in series or in parallel we get $3\Omega, 4\Omega, 12\Omega$ and 16Ω values. Find the values of the two resistors.

View Text Solution

14. A cell of e.m.f. 2V and internal resistance 0.2 Ω supplies a current through an external resistance 9-8Ω. Calculate the current. If an ammeter of resistance 6Ω is included in the circuit, what reading does the ammeter show?

View Text Solution

15. A potentiometer wire of 8m long and 24Ω, resistance is connected in series with an external resistance R and an accumulator of

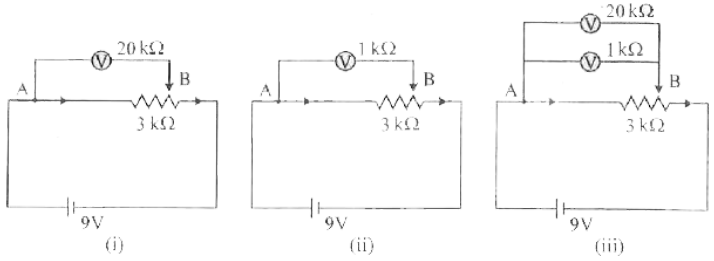
e.m.f. 2V and internal resistance one ohm. What is the value of R in order to have a potential drop of luV/mm of the potentiometer wire?

View Text Solution

16. A battery of emf 9 Vand negligible internal resistance is connected to a 3 kΩ resistor. The potential drop across a part of the resistor [between points A and B in Fig.] is measured by (i) a 20 kΩ voltineter, (ii) a 1 kΩ voltmeter. In

(iii) both the voltmeters are connected across AB. In which case would you get the (1) highest, (2) lowest reading?

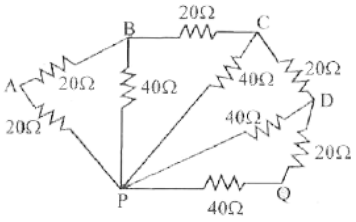
b. Do your answer to this problem alter if the potential drop across the entire resistor is measured? What is the result if the battery has non-negligible internal resistance?



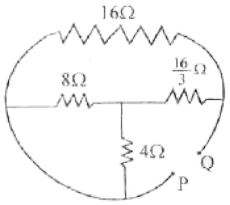
View Text Solution

17. Calculate the effective resistance between P & Q of the following networks.

a.

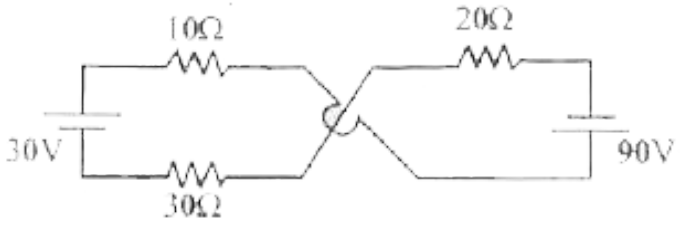


b.



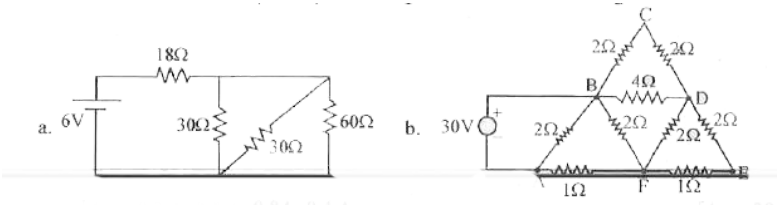
View Text Solution

18. In the circuit given below find the current I and p.d. across 30Ω resistor.



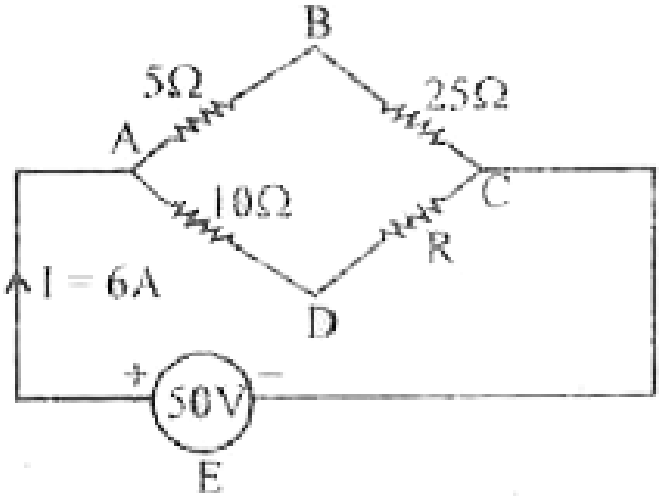
View Text Solution

19. Calculate the current delivered by the voltage source in the following networks.



View Text Solution

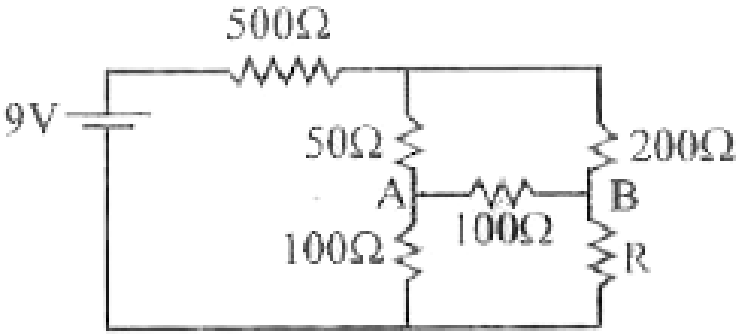
20. Determine the value of R.



View Text Solution

21. Determine the value of R, in the following network, if no current flows through the

branch AB.



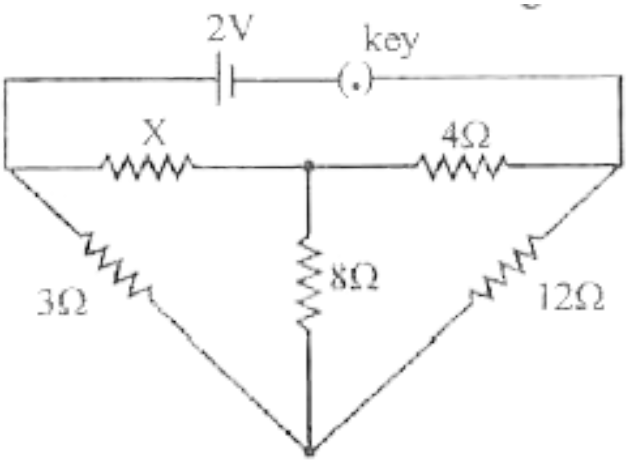
View Text Solution

22. You are given N identical cells each of emf E and internal resistance 'r'. They may be connected in series or in parallel and then across an external resistance R. Show that

both the arrangements will give the same amount of current if R=T.

View Text Solution

23. Calculate the value of x in the following network.



View Text Solution

24. A cell of emf 1.4 V and with resistance 2Ω is put in series with a 100Ω resistor through anammeter. The resistance of the ammeter is $\frac{4}{3}\Omega$. A voltmeter is connected across 100 Ω resistor.

a. When ammeter reads 0.02A, what is the resistance of the voltmeter?

b. When voltmeter reads 1.1 V, what is the error in this reading?

View Text Solution

25. Two cells, each of emf 1.5 V are joined in parallel and provide a supply to two 17Ω resistors connected in parallel. A voltmeter reads the terminal voltage of the cells as 1.4 V each. What is the internal resistance of the cells?

View Text Solution

Evaluation Questions And Answers

1. What do you mean by steady current?

View Text Solution

2. What do you mean by varying current?

View Text Solution

3. In a steady flow, if charge q is flowing through a conductor for a time t, what is the charge flowing per unit time?

View Text Solution

4. In a varying flow, if Δq is the charge flowing in a time Δt, within the limit Deltat rArr` 0, what is the electric current?

View Text Solution

5. Current through a conductor is said to be / C"/"s. What does it mean ?

View Text Solution

6. Why does current become a scalar quantity?

View Text Solution

7. If I is the current passing normal to an area A, what is current per unit area?

View Text Solution

8. What do you mean by current density?

View Text Solution

9. Why is current density a vector quantity?

View Text Solution

10. The free electrons inside a metallic conductor are in random motion. Can we detect current in the conductor?

View Text Solution

11. What is the essential condition for current flow in a conductor?

View Text Solution

12. How can you produce a net flow of electric charges (electric current] in a conductor?

View Text Solution

13. When an electric field (E) is applied to the conductor, what is the force experienced by an electron?

View Text Solution

14. If 'm" is the mass of an electron, what is its acceleration?

View Text Solution

15. In the electric field, what happens to the motion of the electrons?

View Text Solution

16. The number density of conduction electrons in a conductor is $8.5 \times 10^{28} m^{-3}$. The area of cross section is $10^{6} m^{3}$ pr and I = 3A.

a.What is the drift velocity of electrons?

b. Compare the drift velocity of electrons with

thermal velocity.

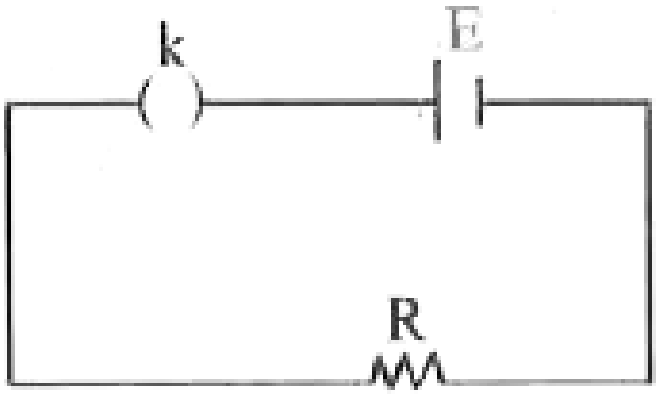
c. What is the time taken by an electron to drift from one end of the condutor 3m longto the other end?

d. The time taken by an electron to travel in a conductor is very large. But when we switch on an electric circuit, there is no time delay to complete the circuit. Why?

View Text Solution

17. a.How can you measure the voltage across resistance and current through the circuit?

b.How can you modify the given circuit to measure voliage across resistance and current through the circuit?



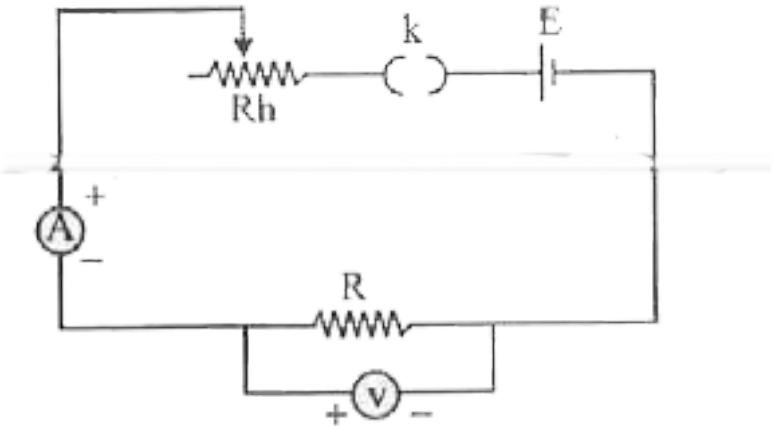
View Text Solution

18. Why is an ammeter connected in series and voltmeter in parallel?

View Text Solution

19. Without replacing the source, how can you vary the potential difference across the

resistance wire?



View Text Solution

20. How can you state the relation between V and I as a law?

View Text Solution

21. What is conductance?

View Text Solution

22. What is the variation of resistance with length and area of cross section of conductor?

View Text Solution

23. What is the relation between drift velocity and relaxation time?

View Text Solution

24. What is the relation between electric field, length of the wire and potential difference between the conductor?

View Text Solution

25. What is the relation between resistivity and relaxation time?

View Text Solution

26. When the temperature increases, what happens to relaxation time?

View Text Solution

27. When relaxation time decreases, what happens to resistivity?

View Text Solution

28. What is the variation of resistivity with temperature?

View Text Solution

29. What happens to the resistivity of a conductor when the temperature becomes absolute zero or 0° K?

View Text Solution

30. What is superconductivity?

View Text Solution

31. How can you define temperature coefficient of resistance?

View Text Solution

32. When the current in the conductor is high, what happens to the conductor?

View Text Solution

33. What is an ohmic resistance?

View Text Solution

34. What is a non-ohmic resistance?

View Text Solution

35. Ohm's law is not a universal law. Why?

View Text Solution

36. In parallel combination, what is the potential difference across each resistor?

View Text Solution

37. a.What is the effective resistance between A and C?

b. How much current enters the circuit through A

c. What is the current through each resistor?

d. What is the amount of current leaving the point A?

e.What is the potential difference between the points A and C?

f. How much emf is applied?

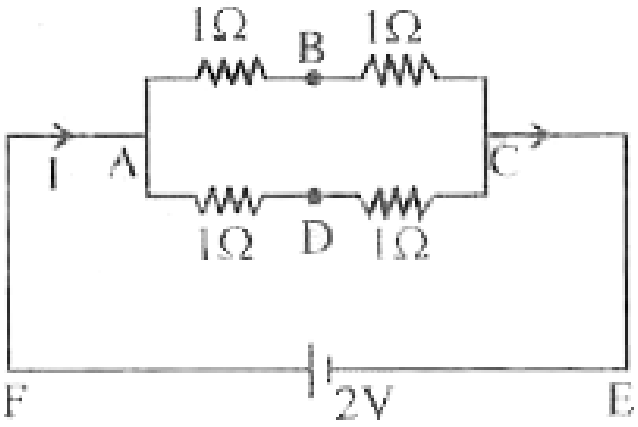
g. What is the value of potential at B?

h. What is the value of potential at D?

i. How much current flows through a galvanometer if it is connected between B and D?

j. If the resistor between A and D is replaced by 2Ω, what happens to galvanometer deflection?

k. Can you again reduce the deflection to zero by adjusting resistance between D and C?

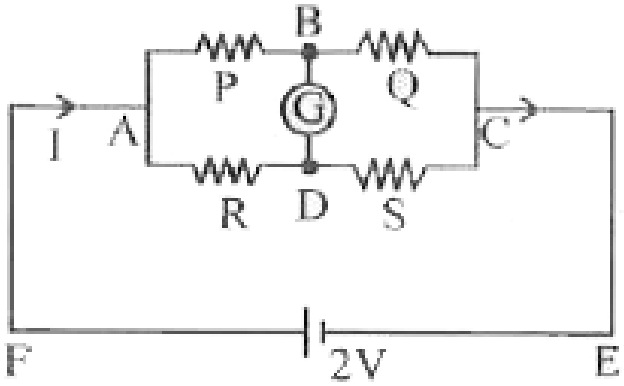


View Text Solution

38. a.What is the general value of potential at B?

b.What is general value of potential at D?

c.What is the condition to obtain zero deflection in galvanometer?



View Text Solution

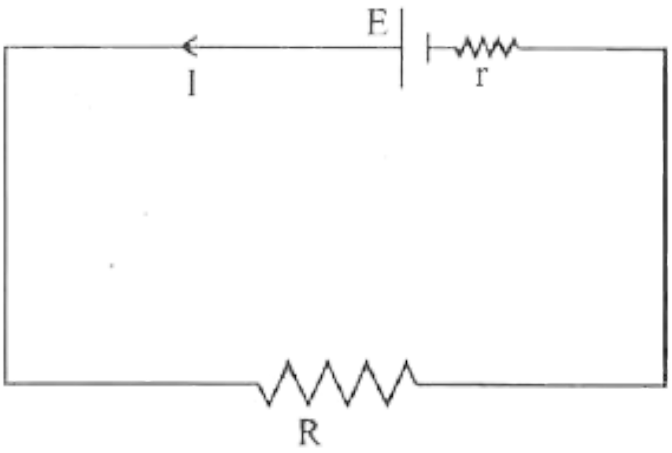
39. a.What is the total resistance in the givencircuit?

b. What is the current in the circuit?

c.What is the potential difference across the terminals of the cell?

d. Is it equal to the emf of the cell?

e.Find the condition under which potential difference and emf are equal?



View Text Solution

40. How can you compare the emf of two cells?

View Text Solution

41. What is meant by internal resistance of a cell? I

View Text Solution

42. Pick the odd one out the following: a. Ohm's law b. Lenz's law c. Coulomb's law d.

Gauss' law e. Faraday's law

View Text Solution

43. The following question consists of two statements each, printed as assertion and reason. While answering these questions you should choose any one of the following responses.

Assertion : In a simple battery circuit, the point at the lowest potential is the positive terminal of the battery

Reason : The electron flows from higher potential to lower potential.

a. Both the assertion and reason are true and the reason is a correct explanation of the assertion.

b. Both the assertion and reason are true but the reason is not a correct explanation of the assertion.

c. Assertion is true but the reason is false.

d. Both the assertion and reason are false.

View Text Solution

44. Match the following

Device	Material	Reason for use
Connecting wire	Constantan	Good conductor
Standard resistance	Alloy	Low melting point and high resistivity
Fuse wire	Copper	Very small temperature coefficient of resistance
	Nichrome	Produces large magnetic field around the coil

View Text Solution

45. Fill in the blanks using the words given in the brackets. [Free electrons, free holes, drift spee, relaxation time , Ohm" s law, critical temperature , zero temperature ,r.m.s speed, super temperature , negative , Coulomb's law, time., constant] In a metallic conductor electri current is due to the movement of (I) ...

Metallic conductors obey $^{(II)}\ldots$. . In superconductors, resistance drops suddenly to zero at a sufficiently low temperature called $^{(iii)}\ldots$... Metals have $^{(iv)}$ temperature coefficient of resitance.

View Text Solution

46. Match the following

A	B	C
Drift speed	Temperature	10^{4}
Relaxation time	Magnetic field	10^{+6}
Electron mobility in metal	Electric field	10^{-7}
	Proportionality constant	10^{-3}

View Text Solution

47. a.SI unit of electric current is ampere. Then what do you mean by saying current is one ampere?

b. Give the relation between electric current and current density and their respective units?

View Text Solution

48. Name the factors on which resistance of a conductor depends on.

b. For a given conductor and at a given

temperature how the resistance depends on

i.its length " " ii. its area of cross section

iii. From the above derive an expression for resistivity.

View Text Solution

49. a. Is Ohms law applicable to all elements? If not give example.

b. Is e.m.f. a force or some other physical quantity?

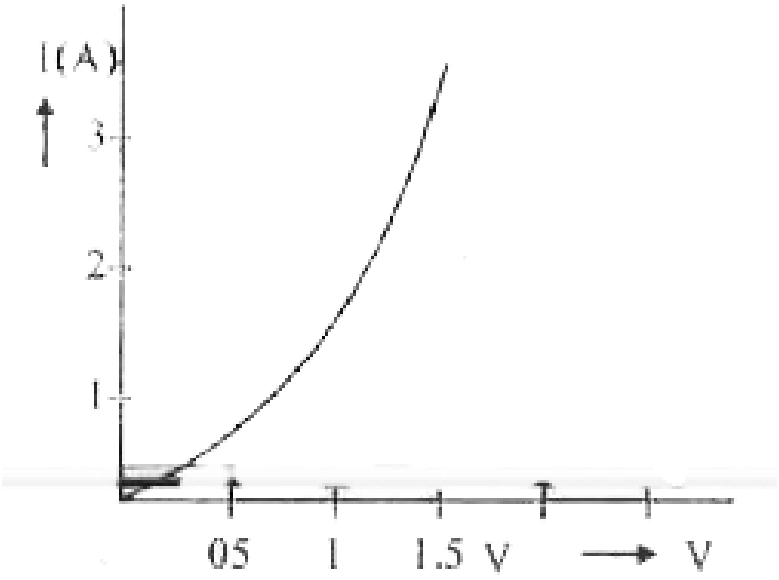
c. Define e.m.f.

d. What is the source of em.f. in a primary cell?

View Text Solution

50. A cell of emf 1.5 V and internal resistance 0.5Ω is connected to a (non-linear) conductor whose V. - I graph is shown in figure. Obtain graphically the current drawn from the cell

and its terminal voltage.



View Text Solution

51. Resistivity of copper, constantan and silver are 1.7x102cm, 39.1x10cm and 10-12cm respectively.

a. Which is the best conductor?

b. Give reason for your answer.

c. Define resistivity.

d. Which material is used for potentiometer wire? Why?

View Text Solution

52. a. If a person touches a live wire, will he get stuck to it?

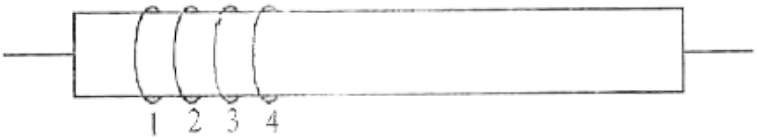
b. Why do we use copper wires as connecting wires?

c. wire is carrying a current. Is it charged? If not, why?

View Text Solution

53. Light from a bathroom bulb gets dimmer for a moment when geiser is switched on. Why?

View Text Solution

54. 

In the above figure, the numbers 1, 2, 3 and 4 have got some meaning.

a.What is the meaning of each number? b. Why is such a system used?

View Text Solution

55. Two potentiometers are shown m ligures (P_1) wild (p_2). The first one hus om tengri um the second one 10 m.

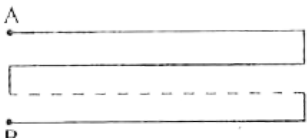


Fig. (P_1)

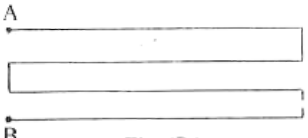


Fig. (P_2)

a.Which one you prefer while finding the internal resistance of a primary cell? Why?

b. Will the balance point be affected by the internal resistance of the given cell?

Suppose you connect the two potentiometers in series, will the combination give you a better accuracy?

d. What important precaution you should take while using the modified connection mentioned in (c)?

View Text Solution

56. What is conventional current?

View Text Solution

57. What is the significance of the direction of current?

View Text Solution

58. How does drift velocity of electrons in a metallic conductor vary with temperature?

View Text Solution

59. How is p.d (V) related to drift velocity (v_d)`?

View Text Solution

60. Define resistivity.

View Text Solution

61. Why are connecting wires made of copper?

View Text Solution

62. What is a thermistor?

View Text Solution

63. A wire is carrying current. Is it charged? Give reason.

View Text Solution

64. Two wires of equal lengths, one of copper and the other of manganin have equal resistance values. Which wire is thicker? Explain.

View Text Solution

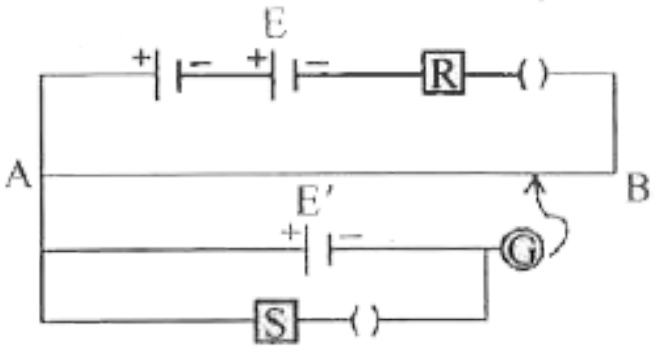
65. Give the colour code of 240MΩ of 10%

View Text Solution

66. Two students X and Y perform an experiment on potentiometer separately using the circuit diagram shown here. Keeping other things unchanged

i. X increases the value of resistance R.

ii. Y decreases the value of resistance S in the set up.How would these changes affect the position of null point in each case and why?



View Text Solution

67. A voltage of 30V is applied across a carbon resistor with first second and third rings of blue, black and yellow colours respectively. Find the value of current through the resistor.

View Text Solution

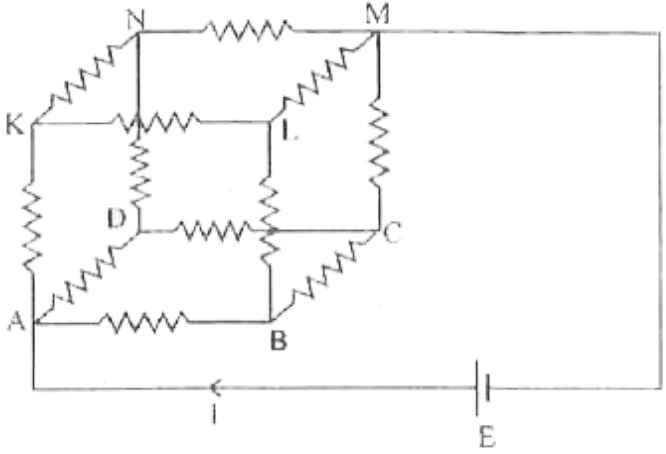
68. One end of an aluminium wire whose diameter is 3 mm is welded to one end of a

copper wire of diameter 2 mm. The composite wire carries a steady current of 20 mA. What is the current density in each wire?

View Text Solution

69. Twelve equal resistors each of resistance 12 Ω form edges of a cube as shown. A battery of emf 24 volts is connected across the diagonally opposite corners of this cube. Deter mine the equivalent resistance and current

through each edge.



View Text Solution

70. 12 cells, each having the same emf are corected in series and are kept in a closed bor. Some of the cells are wrongly connected. The battery is in series with an ammeter and two

cells of identical nature to others. The current is 34 when external cells aid the battery and 2A when they oppose. How many cells are wrongly connected in the battery?

View Text Solution

71. A cell of emf E and internal resistance r is connected to an external resistance R. Show that at maximum power transfer, R =r

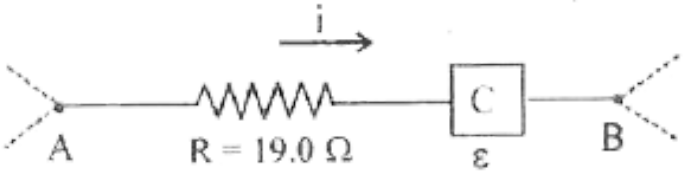
View Text Solution

72. One section AB of a circuit absorbs 53.0W of power when a current i =I.20A passes through it in the direction shown.

a. Find the potential difference between A and B.

b. If the element C does not have an internal resistance, what is its emy?

c. Which terminal, left or right is positive?



View Text Solution

Competitive Exam Corner

1. An electric bulb rated 500 W at 100 V is used in a circuit having a 200 V supply. The resistance R that must be put in series with the bulb, so that the bulb draws 500 W is

A. 10Ω

B. 15Ω

C. 2.5Ω

D. 20Ω

Answer: D

View Text Solution

2. Two resistors of resistances 200kΩ and IMΩ respectively form a potential divider with outerjunctions maintained at potentials of +3 V and -15V. Then, the potential at the junction between the resistors is

A. $+1V$

B. $-0.6V$

C. $d - 12V$

D. $+12V$

Answer: C

View Text Solution

3. The graph between resistivity and temperature for a limited range of temperature, is a straight line for a material like

A. copper

B. nichrome

C. silicon

D. mercury

Answer: B

View Text Solution

4. A rise of temperature of 4°C is observed in a conductor by passing a current. If the

current is tripled, the rise of temperature will be

A. $8^\circ C$

B. $12^\circ C$

C. $16^\circ C$

D. $36^\circ C$

Answer: D

View Text Solution

5. Two electric bulbs marked 40 W, 220 V and 60 W, 220 V when connected in series, across same voltage supply of 220 V, the effective power is P_1, and when connected in parallel, the effective power is p_2 Then $\frac{p_1}{p_2} is$

A. 0.5

B. 0.48

C. 0.24

D. 4.1

Answer:

View Text Solution

6. The resistance of a 10 m long wire is 10Ω. Its length is increased by 25% by stretching the wire uniformly. Then the resistance of the wire will be

A. 12.5Ω

B. 14.5Ω

C. 15.6Ω

D. 18.6Ω

Answer:

View Text Solution

7. If2A of current is passed through $CuSo_4$, solution for 32 seconds, then the number of copperions deposited at the cathode will be

A. 4×10^{20}

B. 2×10^{20}

C. 4×10^{19}

D. 2×10^{19}

Answer: B

View Text Solution

8. In a potentiometer experiment, when three cells, A, B and C are connected in series, the balancing length is found to be 740 cm. If A and B are connected in series, balancing length is 440 cm and for B and C connected in series that is 540 cm. Then the emf of $E_A E_B$, and E_C. are respectively in volts)

A. 1,1.2and1.5

B. 1,2and 3

C. 1.5,2 and3

D. 1.5,2.5and 3.5

Answer: A

View Text Solution

9. Find the true statement.

A. Ohm's law is applicable to all conductors of electricity

B. In an electrolyte solution, the electric current is mainly due to the movement of electrons

C. The resistance of an incandescent lamp is lesser when the lamp is switched on

D. The resistance of carbon decreases with the increase of temperature

Answer:

View Text Solution

10. The tolerance level of a resistor with the colour code red, blue, orange, gold is

A. $\pm 5\ \%$

B. $\pm 10\ \%$

C. $\pm 20\ \%$

D. $\pm 40\ \%$

Answer: A

View Text Solution

11. Two identical conductors maintained at different temperatures are given potential differences in the ratio 1:2. Then the ratio of their drift velocities is

A. "1:2"

B. "3:2"

C. "1:1"

D. "1:4"

Answer: A

View Text Solution

12. On increasing the temperature of a conductor, its resistance increases because the

A. relaxation time increases

B. mass of electron increases

C. electron density decreases

D. relaxation time decreases

Answer: D

View Text Solution

13. Two balleries of emfs 2 V and I V of internal resistances 112 and 212 respectively are connected in parallel. The effective emf of the combination is

A. $\frac{2}{3}V$

B. $\frac{5}{3}V$

C. $\frac{3}{5}V$

D. 2.V

Answer: B

View Text Solution

14. Three identical bulbs connected in series across an accumulator consumes 20 W power. If the bulbs are connected in parallel to the same source, the power consumed is

A. 20W

B. 60W

C. 90W

D. 180W

Answer:

View Text Solution

15. A galvanometer connected with an unknown resistor and two identical cells in series each of emf 2 V shows a current of 1 A. If

the cells are connected in parallel, it shows 0.8 A. Then the internal resistance of the cell is

A. 1Ω

B. 0.5Ω

C. 2.5Ω

D. 0.33Ω

Answer: A

View Text Solution

16. The resistances in the four arms of a Wheatstone network in cyclic order are $5\Omega 2\Omega, 6\Omega \text{ and } 15\Omega$. If a current of 2.8 A enters the junction of 5Ω. then the current through 2Ω resistor is

A. 1.5A

B. 2.8A

C. 0.7A

D. 2.1A

Answer:

View Text Solution

17. Pick out the wrong feature about carbon resistors

A. Compact

B. Inexpensive

C. Relatively sensitive to temperature

D. Mostly used for higher resistor values

Answer: C

View Text Solution

18. The number of electrons per second flowing through any cross section of the wire carrying current of 1 ampere is

A. 3.12×10^{16}

B. 1.6×10^{18}

C. 6.25×10^{16}

D. 6.25×10^{18}

Answer:

View Text Solution

19. Ohm's law is valid if

A. V is directly proportional to 1^3

B. the relation between V and I depends on the sign of V for the same absolute value of V

C. the relation between V and I is non-unique

D. V depends I linearly

Answer:

View Text Solution

20. The resistance and tolerance of a yellow, violet, red colour coded resistor respectively are

A. $47k\Omega.10\ \%$

B. $4.7k\Omega.10\ \%$

C. $47k\Omega.20\ \%$

D. $4.7k\Omega.20\ \%$

Answer: D

View Text Solution

21. Resistances of 12Ω and $X\Omega$ are connected in parallel in the left gap and resistances of 9 and 7Ω are connected in series in the right gap of the meter bridge. If the balancing length is 36 cm, then the value of resistance X is

A. 72Ω

B. 54Ω

C. 36Ω

D. 64Ω

Answer: C

View Text Solution

22. The identical batteries each of emf 2V are connected in series to a 8Ω resistor. If the current in the circuit is 2 A, then the internal resistance of each battery is

A. 0.2Ω

B. 0.3Ω

C. 0.4Ω

D. 0.5Ω

Answer: A

View Text Solution

23. In a potentiometer of wire length 1 a cell of emf V is balanced at a length $\frac{l}{3}$ from the

positive end of the wire. For another cell of emf 1.5 V, the balancing length becomes

A. $\frac{l}{6}$

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

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

D. $\frac{2l}{3}$

Answer: B

View Text Solution

24. The smallest resistance that can be obtained by combining 10 resistors each of resistance 10Ω is

A. 10Ω

B. 0.5Ω

C. 2Ω

D. 20Ω

Answer:

View Text Solution

25. Pick out the wrong statement from the following

A. The SI unit of conductance is mho.

B. Conductance of a conductor decreases with increase in temperature.

C. If the radius of a metallic wire is doubled, its resistance becomes $\left(\frac{1}{4}\right)^{th}$ of original resistance.

D. The relation between voltage and current for a non-ohmic conductor is linear.

Answer:

View Text Solution

26. A given resistor has the following colour code of the various strips on it: Brown, black, green and silver. The value of its resistance in ohm is

A. $1.0 \times 10^4 \pm 10\,\%$

B. $1.0 \times 10^7 \pm 5\,\%$

C. $1.0 \times 10^6 \pm 10\,\%$

D. $1.0 \times 10^5 \pm 5\,\%\, e,$

Answer: C

View Text Solution

27. Which one of the following electrical meter has the smallest resistance?

A. Ammeter

B. Milliammeter

C. Galvanometer

D. Voltmeter

Answer: A

View Text Solution

28. Two wires of the same material having equal area of cross section have lengths Land 2L. Their respective resistances are in the ratio

A. $2:1$

B. $1:1$

C. $1:2$

D. $1:3$

Answer: C

View Text Solution

29. Two bulbs 60 W and 100 W designed for voltage 220 V are connected in series across 220 V source. The net power dissipated is

A. 80W

B. 160W

C. 37.5W

D. 60W

Answer: C

View Text Solution

30. The drift speed of electrons in a copper wire of diameter d and length l is v. If the

potential difference across the wire is doubled, the new drift speed becomes

A. v

B. 2v

C. 3v

D. $\frac{v}{2}$

Answer: B

View Text Solution

31. Five cells each of emf E and internal resistance r send the same amount of current through an external resistance R whether the cells are connected in parallel or in series. Then the ratio $\left(\frac{\mathrm{R}}{\mathrm{r}}\right)$S

A. 2

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

C. $\frac{1}{5}$

D. 1

Answer: D

View Text Solution

32. A uniform wire of resistance 9Ω is joined end-to-end to form a circle. Then the resistance of the circular wire between any two diametrically opposite points is

A. 6Ω

B. 3Ω

C. $\frac{9}{4}\Omega$

D. $\frac{1}{5}\Omega$

Answer: C

View Text Solution

33. 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

Answer: A

View Text Solution

34. The resistivity of the material of a potentiometer wire is $5 \times 10^{-6} \Omega$m and its area of cross section is $5 \times 10^{-6} m^2$. If 0.2 A current is flowing through the wire, then the potential drop per metre length of the wire is

A. $0.1 V m^{-1}$

B. $0.5 V m^{-1}$

C. $0.25m^{-1}$

D. $0.2m^{-1}$

Answer: D

View Text Solution

35. A battery of 6 V and internal resistance 2Ω is connected to a silver voltameter. If the current of 1.5.A flows through the circuit, the resistance of the voltameter is

A. 4Ω

B. 2Ω

C. 6Ω

D. 1Ω

Answer: B

View Text Solution

36. The ratio of resistances of two copper wires of the same length and of same cross

sectional area when connected in series to that when connected in parallel is

A. $1:1$

B. $1:2$

C. $2:1$

D. $1:4$

Answer: D

View Text Solution

37. A flow of 10^6 electrons per second in a conducting wire constitutes a flow of current of

A. $1.6 \times 10^{-15} A$

B. $1.6 \times 10^{-11} A$

C. $1.6 \times 10^{-12} A$

D. $1.6 \times 10^{-13} A$

Answer:

View Text Solution