Ravi Maths Tuition

Current Electricity

12th Standard

Physics

Multiple Choice Question 109 x 1 = 109

1) When a current *I* is set up in a wire of radius r, the drift speed id v_d. If the same current is set up through a wire of radius 2r the drift speed will be

(a) $v_d/4$ (b) $v_d/2$ (c) $2v_d$ (d) $4v_d$

2) Two resistance when connected in parallel have equivalent resistance of 3Ω . When one of the resistance is burnt and broken, the net resistance is 12Ω . What is the resistance of the burnt resistor?

(a) 4Ω (b) 8Ω (c) 12Ω (d) 16Ω

3) The equivalent resistance of n resistors each of same resistance when connected in parallel is R_p. If they are connected in series, the equivalent resistance will be:

(a) R_p/n^2 (b) R_p/n (c) nR_p (d) n^2R_p

4) Three equal resistors each of resistance R are connected so as to form a triangle. The equivalent resistance across any two corners is:

(a) 2R/3 (b) R/3 (c) 3R/2 (d) 3R

5) Four wires each of same length, diameter and material are connected to each other to form a square. If the resistance of each wire is R, then equivalent resistance across the opposite corners is:

(a) R/4 (b) R/2 (c) R (d) none of the above

6) What is the resistance across A and B in the fig

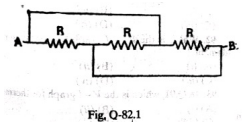


Fig. Q-82.1

(a) 3R (b) R (c) R/3 (d) None of the above

7) What is the resistance across A and B in the fig?

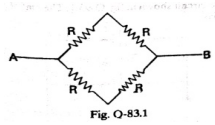


Fig. Q-83.1

(a) $\frac{R}{2}$ (b) R (c) 2R (d) 4R

8) Why the wheatstone bridge is more accurate than the other methods of measuring resistance?

(a) It has four resistor arms (b) It is based on Kirchhoff's laws (c) It does not involve ohm's law

(d) It is a null method

9) What is the resistance between A and B in the fig.

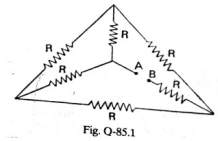


Fig. Q-85.1

(a) R/2 (b) R (c) 2R (d) 3R

10) What is the resistance across A and B in the fig.?

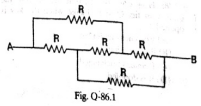


Fig. Q-86.1

(a) R/5 (b) R/3 (c) R (d) 3R

11) According to the Kirchhoff's law the sum of the products of current and resistance as well as emfs in a closed loop is:

(a) greater than zero (b) zero (c) less than zero (d) determained by the emf

12) For higher sensitivity which of the following is essential for the potentiometer?

(a) Higher emf of quxiliary battery (b) Higher resistivity of the wire (c) Larger length of the wire

(d) None of the above

13) Resistivity of a conductor depends upon its:

(a) resistance (b) length (c) area of cross - section (d) none of the above characteristics

14) The length of a conductor is halved. Its conductivity will be

(a) halved (b) unchanged (c) doubled (d) quadrupled

15) The length of a conductor is halved. Its conductance will be:

(a) halved (b) unchanged (c) doubled (d) quadrupled

16) The length and area of cross - section of a conductor are doubled, its resistance will be:

(a) halved (b) unchanged (c) doubled (d) quadrupled

17) Ohms law is valid when the temperature of the conductor is:

(a) constant (b) very high (c) very low (d) varying

18) To obtain maximum resistance by joining the given resistors, they should be grouped in

(a) series (b) parallel (c) mixture of series and parallel combinations

19) A wire of resistance 3Ω is cut into there equal pieces, which are joined to from a triangle. The equivalent resistance between any two corners of the triangle is

(a) $\frac{3}{2}\Omega$ (b) $\frac{2}{3}\Omega$ (c) $\frac{1}{4}\Omega$ (d) 4Ω

20) For ohmic conductor the drift velocity v_d and the electric field applied across it are related as:

(a) $v_d \propto \sqrt{E}$ (b) $v_d \propto E$ (c) $v_d \propto E^{\frac{3}{2}}$ (d) $v_d \propto E^2$

21) A wire is cut into 4 pieces, which are put together side by side to obtain one conductor. If the original resistance of the wire was R, the resistance of the bundle will be:

(a) R/4 (b) R/8 (c) R/16 (d) R/32

22) A wire of resistance R is bent in the form of a circle. The resistance between two points on the circumference of the wire and at the end of a diameter of the circle is:

(a) R/4 (b) R/8 (c) R/16 (d) R/32

23) The smallest resistance that can be obtained by the combination of n resistors, each of resistance R is:

(a) R/n^2 (b) R/n (c) nR (d) n^2R

24) We have two resistors R_1 and R_2 By using them singly in series and parallel combination we can obtain four resistances of 3, 4, 12 and 16 ohms. The R_1 and R_2 are:

(a) 3, 4 (b) 4, 12 (c) 12,16 (d) 16, 3

25) A steady current is set up in a metallic wire of non uniform cross-section. How is the speed of flow v of electrons is related to the area of cross-section A?

(a) v is independent of A (b) $v \propto A^{-1}$ (c) $v \propto A$ (d) $v \propto A^2$

26) The equivalent resistance in series combination is:

(a) smaller than the largest resistance (b) larger than the largest resistance

(c) smaller than the smallest resistance (d) larger than the smallest resistance

27) To draw maximum current from a combination of cells, how should the cells be grouped?

(a) series (b) Parallel (c) Mixed (d) Depends upon the relative values of external and internal resistance

28) Five cells each of internal resistance 0.2Ω and e.m.f. 2V are connected in series with a resistance of 4Ω.The current through the external resistance is:

(a) 0.2A (b) 0.5A (c) 1A (d) 2A

29) You are given three equal resistors. How many groups of resistances can be obtained by joining them in series and parallel grouping?

(a) Two (b) Three (c) Four (d) Six

30) An aluminum wire is drawn through die so as to reduce its diameter to half. If the original resistance be R, the new resistance of the wire will be:

(a) R/16 (b) R/4 (c) 4R (d) 16R

31) An aluminium wire is drawn through a die so as to double its length.If the original resistance be R, than the new resistance of the wire will be:

(a) R/16 (b) R/4 (c) 4R (d) 16R

32) An external resistance R is connected to a cell of internal resistance r.The current in the circuit is maximum when:

(a) R > r (b) R < r (c) R = r (d) cannot be parallel

33) Which of the following has -ve temperature coefficient of resistance?

(a) Tungsten (b) Carbon (c) Nichrome (d) Platinum

34) The resistivity of material is investment proportional to:

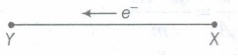
(a) number density of electrons as well and relaxation time

(b) number density of electrons and direction proportional to relaxation time

(c) relaxation time and directly proportional to the number density of electron

(d) neither relaxation time nor number density of electrons.

35) Twenty million electrons reaches from point X to point Y in two micro second as shown in the figure. Direction and magnitude of the current is



(a) 1.5×10^{-10} A from X to Y (b) 1.6×10^{-6} A from Y to X (c) 1.5×10^{-13} A from Y to X

(d) 1.6×10^{-4} A from X to Y

36) The relation between electric current density (J) and drift velocity (v_d) is

(a) $J = nev_d$ (b) $J = \frac{ne}{v_d}$ (c) $J = \frac{v_d e}{n}$ (d) $J = nev^2_d$

37) If drift velocity of electron is v_d and intensity of electric field is E, then which of the following relation obeys the Ohm's law?

(a) v_d = constant (b) $v_d \propto E$ (c) $v_d = \sqrt{E}$ (d) $v_d \propto E^2$

38) Which of the following characteristics of electrons determines the current in a conductor?

(a) Drift velocity alone (b) Thermal velocity alone (c) Both drift velocity and thermal velocity

(d) Neither drift nor thermal velocity

39) The dimensional formula of resistance is

(a) $[ML^2 T^{-2} A^{-2}]$ (b) $[M^2 L^2 T^3 A^{-2}]$ (c) $[ML^2 T^{-3} A^{-2}]$ (d) $[ML^3 T^{-3} A^{-3}]$

40) The resistance of a 10 m long wire is 10Ω. Its length is increased by 25%by stretching the wire uniformly. The resistance of wire will change to

(a) 12.5 Ω (b) 14.5 Ω (c) 15.6 Ω (d) 16.6 Ω

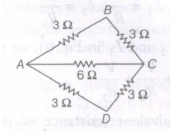
41) A resistor has a colour code of green, blue, brown, and silver. What is its resistance?

(a) 5600 Ω ± 10% (b) 560 Ω ± 5% (c) 560 Ω ± 10% (d) 56 Ω ± 5%

42) Multiplication of resistivity and conductivity of any conductor depends on

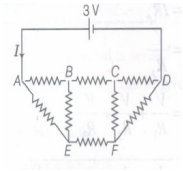
(a) cross-section (b) temperature (c) length (d) None of these

43) In the following diagram, equivalent resistance between A and D is



(a) 5 Ω (b) 4 Ω (c) 3Ω (d) 2Ω

44) Figure shows a network of eight resistors, each equal to 2Ω, connected to a 3V battery of negligible internal resistance. The current I in the circuit is



(a) 0.25 A (b) 0.50 A (c) 0.75 A (d) 1.0 A

45) The equivalent resistance of n resistors each of same resistance when connected in series is R. If the same resistances are connected in parallel, the equivalent resistances will be

(a) R/n^2 (b) R/n (c) $n^2 R$ (d) nR

46) A television of 200 W is used for 4h, then what is the value unit expense of electricity?

(a) 50 (b) 20 (c) 0.8 (d) 0.2

47) Two bulbs of 40W and 60W are connected to 220V line, the ratio of resistance will be

(a) 4 : 3 (b) 3 : 4 (c) 2 : 3 (d) 3 : 2

48) A 100 W-220 V bulb is connected to a supply of 110 V. The power dissipated in the bulb will be

(a) 100 W (b) 50 W (c) 25 W (d) 2 W

49) The internal resistance of a 2.1 V cell which gi es a current of 0.2 A through a resistance of 10 Ω is

(a) 0.2 Ω (b) 0.5 Ω (c) 0.8 Ω (d) 1.0 Ω

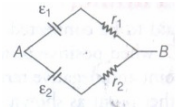
50) The cell has an emf of 2V and the internal resistance of this cell is 0.1Ω, it is connected to resistance of 3.9Ω, the voltage across the cell will be

(a) 1.95 V (b) 1.5V (c) 2 V (d) 1.8 V

51) Electromotive force of primary cell is 2.4 V. When cell is short circuited, then current becomes 4A. Internal resistance of cell is

(a) 60 Ω (b) 1.2 Ω (c) 4 Ω (d) 0.6 Ω

52) Two batteries of emf ε_1 and ε_2, ($\varepsilon_2 > \varepsilon_1$) and internal resistances r_1 and r_2 respectively are connected in parallel as shown in figure.



(a) Two equivalent emf ε_{eq} of the two cells is between ε_1 and ε_2 i.e., $\varepsilon_2 < \varepsilon_{eq} < \varepsilon_2$

(b) The equivalent emf ε_{eq} is smaller than ε_1 (c) The ε_{eq} is given by $\varepsilon eq = \varepsilon_1 + \varepsilon_2$ always

(d) ε_{eq} is independent of internal resistances ε_1 and ε_2

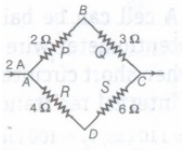
53) Kirchhoff's current law is consequence of conservation of

(a) energy (b) momentum (c) charge (d) mass

54) Which of the following draws no current from the voltage source being measured?

(a) Meter bridge (b) Wheatstone bridge (c) Potentiometer (d) None of these

55) If 2 A current is flowing in the shown circuit, then potential difference (VB - VD) in balanced condition is

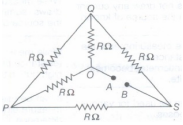


(a) 12 V (b) 6 V (c) 4 V (d) zero

56) The Wheatstone bridge and its balance condition provide a practical method for determination of an

(a) known resistance (b) unknown resistance (c) Both (a) and (b) (d) None of the above

57) If each of the resistance in the network in figure is R, the equivalent resistance between terminals A and B is



(a) 5 R (b) 2 R (c) 4 R (d) R

58) A resistance R is to be measured using a meter bridge, student chooses the standard resistance S to be won. He finds the null point at l, = 2.9 em. He is told to attempt to improve the accuracy. Which of the following is a useful way?

(a) He should measure l_1 more accurately (b) He should change Sto 1000Ω and repeat the experiment

(c) He should change S to 3Ω and repeat the experiment

(d) He should given up hope of a more accurate measurement with a meter bridge

59) Two cells of emfs approximately 5 V and l0 V are to be accurately compared using a potentiometer of length 400 cm.

(a) The battery that runs the potentiometer should have voltage of 8V

(b) The battery of potentiometer can have a voltage of 15 V and R adjusted so that the potential drop across the wire slightly exceeds 10 V

(c) The first portion of 50 cm of wire itself should have a potential drop of 10 V

(d) Potentiometer is usually used for comparing resistances and not voltages

60) 2 mA current is flowing in the wire of potentiometer of 5m long and 5 Ω resistance. The potential gradient is

(a) 2×10^{-3} V/m (b) 2.5×10^{-2} V/m (c) 1.6×10^{-3} V/m (d) 2.3×10^{-3} V/m

61) A potential difference V is applied to a copper wire of length I and diameter d. If V is doubled, then the drift velocity

(a) is doubled (b) is halved (c) remains same (d) becomes zero

62) A potential difference of 100 V is applied to the ends of a copper wire one metre long. What is the average drift velocity of electrons?
(given. $\sigma = 5.81 \times 10^7\ \Omega^{-1}$ or $n_{cu} = 8.5 \times 10^{28}\ m^{-3}$)

(a) 0.43 ms^{-1} (b) 0.83 ms^{-1} (c) 0.52 ms^{-1} (d) 0.95 ms^{-1}

63) Unit of specific resistance is

(a) ohm $^{-1}$ -m $^{-1}$ (b) ohm $^{-1}$ -m (c) ohm-m $^{-1}$ (d) ohm-m

64) The length of 50 Ω resistance becomes twice by stretching. The new resistance is

(a) 25 Ω (b) 50 Ω (c) 100 Ω (d) 200 Ω

65) A metal rod of length 10 cm and a rectangular cross-section of l cm $\times \frac{1}{2}$ cm is connected to a battery across opposite faces. The resistance will be

(a) maximum when the battery is connected across 1 cm $\times \frac{1}{2}$ cm faces

(b) maximum when the battery is connected across 10 cm x 1 cm faces

(c) maximum when the battery is connected across 10 cm $\times \frac{1}{2}$ cm faces

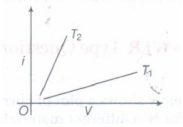
(d) same irrespective of the three faces

66) Corresponding to the resistance $4.7 \times 10^6 \Omega \pm 5\%$ which is order of colour coding on carbon resistors?

(a) Yellow, violet, blue, gold (b) Yellow, violet, green, gold (c) Orange, blue, green, gold

(d) Orange, blue, violet, gold

67) The current i and voltage Vgraph for a given metallic wire at two different temperatures T, and T2 are shown in the figure. It is concluded that

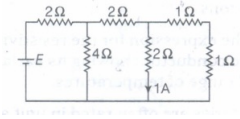


(a) $T_1 > T_2$ (b) $T_1 < T_2$ (c) $T_1 = T_2$ (d) $T_1 = 2T_2$

68) The electromotive force of cell is 5V and its internal resistance is 2 Ω. This cell is connected to external resistance. If the current in the circuit is 0.4 A, then voltage of poles of cell is

(a) 5 V (b) 5.8 V (c) 4.6 V (d) 4.2 V

69) The emf of the battery shown in figure is



(a) 12 V (b) 13 V (c) 16 V (d) 18 V

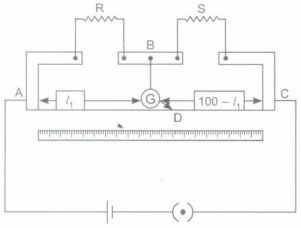
70) Consider a current carrying wire current I in the shape of a circle. Note that as the current progresses along the wire, the direction of j (current density) changes in an exact manner, while the current I remain unaffected. The agent that is essentially responsible for is

(a) source of emf. (b) electric field produced by charges accumulated on the surface of wire.

(c) the charges just behind a given segment of wire which push them just the right way by repulsion

(d) the charges ahead.

71) In a meter bridge, the point D is a neutral point (figure).



(a) The meter bridge can have other neutral point for this set of resistances.

(b) When the jockey contacts a point on meter wire left of D, current flows to B from the wire

(c) When the jockey contacts a point on the meter wire to the right of D, current flows from B to the wire through galvanometer.

(d) When R is increased, the neutral point shifts to left.

72) Which of the following is wrong? Resistivity of a conductor is

(a) independent of temperature. (b) inversely proportional to temperature

(c) independent of dimensions of conductor. (d) less than resistivity of a semiconductor.

73) Drift velocity v_d varies with the intensity of electric field as per the relation

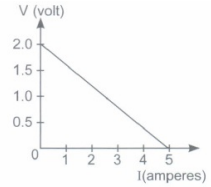
(a) $v_d \propto E$ (b) $v_d \propto \frac{1}{E}$ (c) v_d = constant (d) $\boldsymbol{v_d \propto E^2}$

74) For measurement of potential difference, a potentiometer is preferred over voltmeter because

(a) potentiometer is more sensitive than voltmeter. (b) the resistance of potentiometer is less than voltmeter.

(c) potentiometer is cheaper than voltmeter (d) potentiometer does not take current from the circuit.

75) For a cell, the graph between the potential difference (V) across the terminals of the cell and the current (I) drawn from the cell is shown in the figure.



(a) $2\ \mathrm{V}, 0.5\Omega$ (b) $2\ \mathrm{V}, 0.4\Omega$ (c) $> \mathbf{2V}, \mathbf{0.5\Omega}$ (d) $> \mathbf{2V}, \mathbf{0.4\Omega}$

76) A Daniel cell is balanced on 125 cm length of a potentiometer wire. Now the cell is short-circuited by a resistance 2 ohm and the balance is obtained at 100 cm. The internal resistance of the Daniel cell is

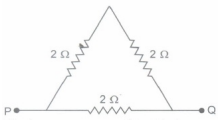
(a) 0.5 ohm (b) 1.5 ohm (c) 1.25 ohm (d) 4/5 ohm

77) When there is an electric current through a conducting wire along its length, then an electric field must exist

(a) outside the wire but normal to it. (b) outside the wire but parallel to it (c) inside the wire but parallel to it.

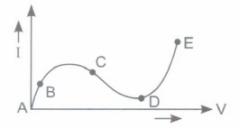
(d) inside the wire but normal to it

78) Three resistors each of 2 ohm are connected together in a triangular shape. The resistance between any two vertices will be



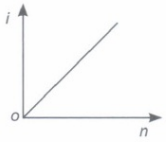
(a) 4/3 ohm (b) 3/4 ohm (c) 3 ohm (d) 6 ohm

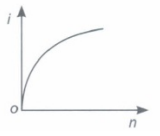
79) From the graph between current I and voltage V shown below, identify the portion corresponding to negative resistance

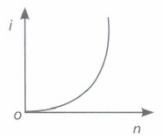


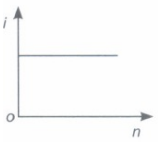
(a) AB (b) BC (c) CD (d) DE

80) A battery consists of a variable number 'n' ofidentical cells having internal resistances connected in series. The terminals of battery are short circuited and the current i is measured. Which of the graph below shows the relationship between i and n?

(a) 

(b) 

(c) 

(d) 

81) Kirchhoff's junction rule is a reflection of

(a) conservation of current density vector. (b) conservation of potential

(c) the fact that the momentum with which a charged particle approaches a junction is unchanged (as a vector) as the charged particle leaves the junction

(d) the fact that there is no accumulation of charges at a junction.

82) Ohm's law is true.

(a) For metallic conductors at low temperature. (b) For metallic conductors at high temperature

(c) For electrolytes when current passes through them (d) For diode when current flows

83) Temperature dependence of resistivity p(T) of semiconductors, insulators and metals is significantly based on the following factors:

(a) number of charge carriers can change with temperature T

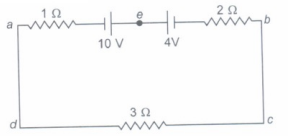
(b) time interval between two successive collisions is independent on T.

(c) length of material can be a function of T. (d) mass of carriers is a function of T

84) A cell of internal resistance 1.5 Ω and e.m.f. 1.5 volt balances on 500 cm length of a potentiometer wire. If a wire of 15 Ω is connected between the balance point and the cell, then the balance point will shift

(a) to zero (b) by 500 cm (c) by 750 cm (d) no change

85) The magnitude and direction of the current in the circuit shown will be



(a) 7/3A from a to b through e (b) 7/3A from b to a through e (c) 1 A from b to a through e

(d) 1 A from a to b through e

86) In an experiment of meter bridge, a null point is obtained at the centre of the bridge wire. When a resistance of 10 ohm is connected in one gap, the value of resistance in other gap is

(a) 10 Ω (b) 5 Ω (c) 15 Ω (d) 500 Ω

87) The terminal potential difference of a cell is greater than its e.m.f. when it is

(a) being discharged. (b) in open circuit (c) being charged. (d) being either charged or discharged.

88) If the length of potentiometer wire is increased, then the length of the previously obtained balance point will

(a) increase. (b) decrease. (c) remain unchanged. (d) become two times.

89) A steady current of 8 mA flows through a wire.The number of electrons passing through a cross-section of the wire in 10 s is

(a) 4.0×10^{16} (b) 5.0×10^{17} (c) 1.6×10^{16} (d) 1.0×10^{17}

90) The current in a device varies with time t as I=6t, whereI is in mÁ and t is in s. The amount of charge that passes through thedevice during t=0s to t= 3s is

(a) 10 mC (b) 18 mC (c) 27 mC (d) 54 mC

91) Pieces of copper and silicon are initially at room temperature. Both are heated to temperature T.
The conduction of

(a) both increases (b) both decreases (c) copper increases and silicon decreases

(d) copper decreases and silicon increases

92) A conductor of 10Ω is connected across a 6V ideal source. The power supplied by the source to the conductor is

(a) 1.8W (b) 2.4W (c) 3.6W (d) 7.2W

93) A cell of emf E is connected across an external resistance R. When current I is drawn from the cell, the potential difference across the electrodes of the cell drops to V. The internal resistance r of the cell is

(a) $\left(\frac{E-V}{E}\right) R$ (b) $\left(\frac{E-V}{R}\right)$ (c) $\frac{(E-V)R}{I}$ (d) $\left(\frac{E-V}{V}\right) R$

94) The current density due to drift of electrons in a conductor is given by (symbols have their usual meanings)

(a) $neAv_d$ (b) $\frac{nAv_d}{e}$ (c) $\frac{nv_d}{eA}$ (d) nev_d

95) A current of 0.8 A flows in a conductor of 40Ω for 1 min. The heat produced in the conductor will be

(a) 1445 J (b) 1536 J (c) 1569 J (d) 1640 J

96) The electric power consumed by a 220 V-100 W bulb, when operated at 110 V is

(a) 25 W (b) 30 W (c) 35 W (d) 45 W

97) If an ammeter is to be used in place of a voltmeter, then we must connect with the ammeter a

(a) low resistance in parallel (b) low resistance in series (c) high resistance in parallel

(d) high resistance in series

98) Kirchhoff's first rule, EI = 0 and second rule, ΣIA = ΣE (where the symbols have their usual meanings) are respectively, based on

(a) conservation of momentum and conservation of charge

(b) conservation of energy and conservation of charge

(c) conservation of charge and conservation of momentum

(d) conservation of charge and conservation of energy

99) Which of the following has negative temperature coefficient of resistivity?

(a) Metal (b) Metal and semiconductor (c) Semiconductor (d) Metal and alloy

100) If the potential difference V applied across a conductor is increased to 2V with its temperature kept constant, then the drift velocity of the free electrons in a conductor will

(a) remain the same (b) become half of its previous value (c) be double of its initial value (d) become zero

101) A constant voltage is applied between the two ends of a uniform metallic wire, heat His developed in it. If another wire of the same material, double the radius and twice the length as compared to original wire is used, then the heat developed in it will be

(a) H/2 (b) H (c) 2H (d) 4H

102) In a DC circuit, the direction of current inside the battery and outside the battery, respectively are

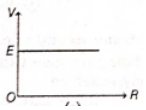
(a) positive to negative terminal and negative to positive terminal

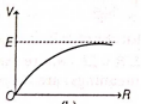
(b) positive to negative terminal and positive to negative terminal

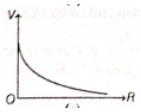
(c) negative to positive terminal and positive to negative terminal

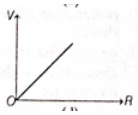
(d) negative to positive terminal and negative to positive terminal

103) A cell of emf (E) and internal resistance is connected across a variable external resistance R. The graph of terminal potential difference V as a function of R is

(a) 

(b) 

(c) 

(d) 

104) In a DCcircuit,the direction of current inside the battery and outside the battery, respectively are

(a) positive to negative terminal and negative to positive terminal

(b) positive to negative terminal and positive to negative terminal

(c) negative to positive terminal and positive to negative terminal

(d) negative to positive terminal and negative to positive terminal

105) A car battery is charged by a 12 V supply and energy stored in it is 720 x 10^5 J. The charge passed through the battery is

(a) 6.0×10^4 C (b) 5.8×10^3 J (c) 8.64×10^6 J (d) 1.6×10^5 C

106) If n,e, τ and m have their usual meanings, then the resistance of a wire of length and cross-sectional area A is given by

(a) $\frac{ne^2A}{2m\tau l}$ (b) $\frac{ml}{ne^2\tau A}$ (c) $\frac{m\tau A}{ne^2l}$ (d) $\frac{ne^2\tau A}{2ml}$

107) Two sources of equal emf are connected in series. This combination is in turn connected to an external resistance R. The internal resistance of two sources are r_1 and r_2 ($r_2 > r_1$). If the potential difference across the source of internal resistance r_2 is zero, then R equals to

(a) $\frac{r_1+r_2}{r_2-r_1}$ (b) $r_2 - r_1$ (c) $\frac{r_1r_2}{r_2-r_1}$ (d) $\frac{r_1+r_2}{r_1r_2}$

108) A potential difference of 200 V is maintained across a conductor of resistance 100Ω. The number of electrons passing through it in 1s is

(a) 1.25 x 10^{19} (b) 2.5 x 10^{18} (c) 1.25 x 10^{18} (d) 2.5 x 10^{16}

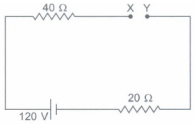
109) The equivalent resistance between A and B of the network shown in figure is

(a) 3RΩ (b) (3/2)RΩ (c) 2RΩ (d) (2/3)RΩ

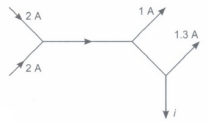
Fill up / 1 Marks 15 x 1 = 15

110) There are n similar conductors each of resistance R. The resultant resistance comes out to be x when connected in parallel. If they are connected in series, the resistance comes out to be _____.

111) In the circuit shown, potential difference between X and Y is _____ and across 40 Ω is _____.

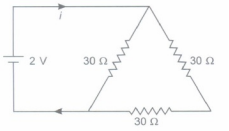


112) The figure below shows currents in a part of electric circuit. The current i is _____.



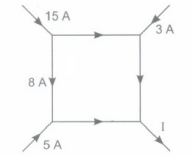
113) A wire is stretched so as to change its length by 0.1 %, the percentage increase in its resistance will be _____.

114) The current in the given circuit will be _____.



115) A cell of emf E is connected with an external resistance R, then p.d. across cell is V. The internal resistance of cell will be _____.

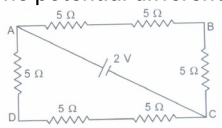
116) The figure shows a network of current and the magnitude of current. The current I will be _____.



117) Kirchhoff's first law, i.e.Σi = 0 at a junction is based on the law of conservation of _____.

118) Kirchhoff's second law is based on the law of conservation of _____.

119) The potential difference between points A and B of given figure is _____.



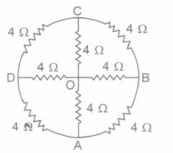
120) A cell of e.m.f. 1.5V having a finite internal resistance is connected to a load resistance of 2Ω. For maximum power transfer the internal resistance of the cell should be _____.

121) When the current i is flowing through a conductor, the drift velocity is v. If 2i current flows through the same metal but having the double area of cross-section, then the drift velocity will be _____.

122) Two wires of the same metal have same length but their cross-sections are in the ratio 3 : 1, they are joined in series. The resistance of the thicker wire is 10 Ω. The total resistance of the combination is _____.

123) Two resistors having value in ratio 2 : 1 are connected in parallel with one cell then the ratio of power dissipated is _____.

124) Eight resistances each of 4 Ω are connected in the circuit as shown in figure. The equivalent resistance between A and B is _____.



Assertion and reason 26 x 1 = 26

125) **Assertion:** Current is a scalar quantity.
Reason: Electric current arises due to continuous flow of charged particles or ions.
Codes:
(a) Both A and R are true and R is the correct explanation of A
(b) Both A and R are true but R is NOT the correct explanation of A
(c) A is true but R is false
(d) A is false and R is also false

126) **Assertion :** Insulator do not allow flow of current through them.
Reason: Insulator have no free charge carrier.
Codes:
(a) Both A and R are true and R is the correct explanation of A
(b) Both A and R are true but R is NOT the correct explanation of A
(c) A is true but R is false
(d) A is false and R is also false

127) **Assertion:** The drift velocity of electrons in a metallic wire will decrease, if the temperature of the wire is increased.
Reason: On increasing temperature, conductance of metallic wire decreases.
Codes:
(a) Both A and R are true and R is the correct explanation of A
(b) Both A and R are true but R is NOT the correct explanation of A
(c) A is true but R is false
(d) A is false and R is also false

128) **Assertion:** The current flowing through a conductor is directly proportional to the drift velocity.
Reason: As the drift velocity increases the current following through the conductor decreases
Codes:
(a) Both A and R are true and R is the correct explanation of A
(b) Both A and R are true but R is NOT the correct explanation of A
(c) A is true but R is false
(d) A is false and R is also false

129) **Assertion:** Chemical reactions involved in primary cells are irreversible and in secondary cells are reversible.
Reason: Primary cells can be recharged, but secondary cells can not be recharged.
Codes:
(a) Both A and R are true and R is the correct explanation of A
(b) Both A and R are true but R is NOT the correct explanation of A
(c) A is true but R is false
(d) A is false and R is also false

130) **Assertion:** The average thermal velocity of the electrons in a conductor is zero.
Reason: Direction of motion of electrons are randomly oriented.
Codes:
(a) Both A and R are true and R is the correct explanation of A
(b) Both A and R are true but R is NOT the correct explanation of A
(c) A is true but R is false
(d) A is false and R is also false

131) **Assertion:** If the length of the conductor is doubled, the drift velocity will become half of the original value (keeping potential difference unchanged).
Reason : At constant potential difference, drift velocity is inversely proportional to the length of the conductor.
Codes:
(a) Both A and R are true and R is the correct explanation of A
(b) Both A and R are true but R is NOT the correct explanation of A
(c) A is true but R is false
(d) A is false and R is also false

132) **Assertion:** The temperature coefficient of resistance is always positive only for metals.
Reason: On increasing the temperature, the resistance of metals and alloys increases.
Codes:
(a) Both A and R are true and R is the correct explanation of A
(b) Both A and R are true but R is NOT the correct explanation of A
(c) A is true but R is false
(d) A is false and R is also false

133) **Assertion:** Material used in the construction of a standard resistance is constant an or manganin.
Reason: Temperature coefficient of constantan is very small.
Codes:
(a) Both A and R are true and R is the correct explanation of A
(b) Both A and R are true but R is NOT the correct explanation of A
(c) A is true but R is false
(d) A is false and R is also false

134) **Assertion:** kWhr is a commercial unit used for expressing consumed electric energy.
Reason: Kilo-watt hour is the unit of electric power.
Codes:
(a) Both A and R are true and R is the correct explanation of A
(b) Both A and R are true but R is NOT the correct explanation of A
(c) A is true but R is false
(d) A is false and R is also false

135) **Assertion:** The 200 W bulbs glows with more brightness than 100 W bulbs.
Reason: A 100 watt bulb has more resistance than a 200 W bulb.
Codes:
(a) Both A and R are true and R is the correct explanation of A
(b) Both A and R are true but R is NOT the correct explanation of A
(c) A is true but R is false
(d) A is false and R is also false

136) **Assertion:** Heater wire must have high resistance and high melting point.
Reason: If resistance is high, the electric conductivity will be less.
Codes:
(a) Both A and R are true and R is the correct explanation of A
(b) Both A and R are true but R is NOT the correct explanation of A
(c) A is true but R is false
(d) A is false and R is also false

137) **Assertion**: Fuse wire must have high resistance and low melting point.
Reason: Fuse is used for small current flow only.
Codes:
(a) Both A and R are true and R is the correct explanation of A
(b) Both A and R are true but R is NOT the correct explanation of A
(c) A is true but R is false
(d) A is false and R is also false

138) **Assertion:** In a chain of bulbs, 50 bulbs are joined in series. One bulb is removed now the circuit is again completed. If the remaining 49 bulbs are again connected in series across the same supply, then light gets decreased in the room.
Reason: The resistance of 49 bulbs will be more than 50 bulbs.
Codes:
(a) Both A and R are true and R is the correct explanation of A
(b) Both A and R are true but R is NOT the correct explanation of A
(c) A is true but R is false
(d) A is false and R is also false

139) **Assertion:** Two electric bulbs of 50 and 100 watt are given. When connected in series 50 watt bulb glows more but when connected in parallel 100 watt bulb glows more .
Reason: In series combination, power is directly proportional to the resistance of circuit. But in parallel combination, power is inversely proportional to the resistance of the circuit.
Codes:
(a) Both A and R are true and R is the correct explanation of A
(b) Both A and R are true but R is NOT the correct explanation of A
(c) A is true but R is false
(d) A is false and R is also false

140) **Assertion:** It is advantageous to transmit electric power at high voltage.
Reason: High voltage implies high current.
Codes:
(a) Both A and R are true and R is the correct explanation of A
(b) Both A and R are true but R is NOT the correct explanation of A
(c) A is true but R is false
(d) A is false and R is also false

141) **Assertion:** Two bulbs of same wattage, one having a carbon filament and the other having a metallic filament are connected in series. Metallic bulbs will glow more brightly than carbon filament bulb.
Reason: Carbon is a semiconductor.
Codes:
(a) Both A and R are true and R is the correct explanation of A
(b) Both A and R are true but R is NOT the correct explanation of A
(c) A is true but R is false
(d) A is false and R is also false

142) **Assertion**: A person touching a high power line gets stuck with the line.
Reason: The current carrying wire attracts the man towards it.
Codes:
(a) Both A and R are true and R is the correct explanation of A
(b) Both A and R are true but R is NOT the correct explanation of A
(c) A is true but R is false
(d) A is false and R is also false

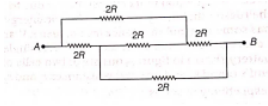
143) **Assertion:** Though the same current flows through the live wires and the filament of the bulb but heat produced in the filament is much higher than that in live wires.
Reason: The filament of bulbs is made of a material of high resistance and high melting point.
Codes:
(a) Both A and R are true and R is the correct explanation of A
(b) Both A and R are true but R is NOT the correct explanation of A
(c) A is true but R is false
(d) A is false and R is also false

144) **Assertion:** The current in a wire is due to flow of free electrons in a definite direction.
Reason: A current carrying wire should have non -zero charge.
Codes:
(a) Both A and R are true and R is the correct explanation of A
(b) Both A and R are true but R is NOT the correct explanation of A
(c) A is true but R is false
(d) A is false and R is also false

145) **Assertion (A)** The temperature coefficient of resistance is positive for metals and negative for p-type semiconductors.
Reason (R) The charge carriers in metals are negatively charged whereas the majority charge carriers in p-type semiconductors are positively charged.
(a) If both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A).
(b) If both Assertion (A) and Reason (R) are true but Reason (R) is not the correct explanation of Assertion (A).
(c) If Assertion (A) is true and Reason (R) is false.
(d) If both Assertion (A) and Reason (R) are false.

146) **Assertion (A)** When electrons drift in a conductor, it does not mean that all free electrons in the conductor are moving in the same direction.
Reason (R) The drift velocity is superimposed over large random velocities of electrons.
(a) If both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A).
(b) If both Assertion (A) and Reason (R) are true but Reason (R) is not the correct explanation of Assertion (A).
(c) If Assertion (A) is true and Reason (R) is false.
(d) If both Assertion (A) and Reason (R) are false.

147) (a) Both Assertion and Reason are true and Reason is the correct explanation ofAssertion.
(b)Both Assertion and Reason are true but Reason is not the correct explanation ofAssertion.
(c) Assertion is true but Reason is false.
(d) Assertion is false but Reason is true.
Assertion (A) The equivalent resistance between' points A and B in the given network is 2R.
Reason (R) All the resistors are connected in



148) Assertion (A) : As the temperature of a 147 B conducting wire increases, the drift velocity of the electrons also increases.
Reason (R) : With an increase in temperature, the average time of collision decreases.
(a) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.
(b) Both Assertion and Reason are true but Reason is not the correct explanation of Assertion.
(c) Assertion is true but Reason is false.
(d) Assertion is false but Reason is true.

149) Assertion (A) : Manganin and constantan are widely used in standard resistors.
Reason (R) : Manganin and constantan resistances values would change very little with temperatures.
(a) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.
(b) Both Assertion and Reason are true but Reason is not the correct explanation of Assertion.
(c) Assertion is true but Reason is false.
(d) Assertion is false but Reason is true.

150) Assertion (A) : Higher the range, lower is the resistance of an ammeter.
Reason (R) : To increase the range of an ammeter, additional shunt is added in series to it
(a) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.
(b) Both Assertion and Reason are true but Reason is not the correct explanation of Assertion.
(c) Assertion is true but Reason is false.
(d) Assertion is false but Reason is true.

2 Marks 374 x 2 = 748

151) The storage battery of a car has an emf of 12 V. If the internal resistance of the battery is 0.4Ω , what is the maximum current that can be drawn from the battery?

152) A negligibly small current is passed through a wire length 15 m and uniform cross-section $6.0 \times 10^{-7} m^2$ and its resistance is measured to be 5.0Ω . What is the resistivity of the material at the temperature of the experiment?

153) (a) In 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 field inside the conductor. But force should cause acceleration. Why then do the electrons acquire a steady average drift speed?
(c) 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?

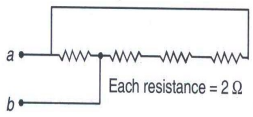
154) The resistance of the platinum wire of a platinum resistance thermometer at the ice point is 5 Ω and at steam point is 5.23 Ω. When the thermometer is inserted in a hot bath, the resistance of the platinum wire is 5.795 Ω. Calculate the temperature of the bath.

155) E.M.F of a cell is 1.5V and its internal resistance 1Ω . For what current drawn from the cell will its terminal potential difference be half of its e.m.f?

156) A storage battery of e.m. 12.0V and internal resistance 0.5Ω is to be charged by a 120Vd.c. supply of negligible internal resistance. What resistance is required in the circuit for the charging current to be 3A? What is the terminal voltage o the battery during charging?

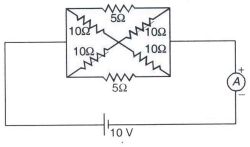
157) Two identical cells of e.m.f 1.5V each joined in parallel provide supply to an external circuit consisting of two resistors of 17Ω each joined in parallel. A very high resistance voltmeter reads the terminal voltage of the cells to be 1.4V. What is the internal resistance of each cell?

158) Calculate R_{ab} in the following circuit:

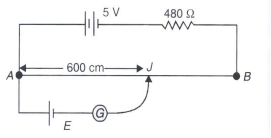


159) Storage battery of a car has an e.m.f of 12V. If the internal resistance of the battery is 0.4Ω What is the maximum current that can be drawn from the battery?

160) A potential difference of 2V is applied between the points A and B as shown in the network drawn in the figure. Calculate
(i) equivalent resistance of the network across the points A and B and
(ii) the magnitudes o currents flowing in the arms AFCEB and AFDEB.



161) A 10 m long wire AB of uniform area of cross-section and 20Ω resistance is used as a potentiometer wire. This wire is connected in series with a battery of 5V and a resistor o 480Ω . An unknown e.m.f. is balanced at 600cm of the wire as shown in the figure. Calculate
(i) the potential gradient for the potentiometer wire.
(ii) the value of unknown e.m.f. E.



162) What conclusion can you draw from the following observations on a resistor made of alloy manganin:

Current (in A)	Voltage (in V)	Current (in A)	Voltage(in V)
0.2	3.94	3.0	59.2
0.4	7.87	4.0	78.2
0.6	11.8	5.0	98.6
0.8	15.7	6.0	118.5
1.0	19.7	7.0	138.2
2.0	39.4	8.0	158.0

163) Is electric current a vector or scalar quantity? Explain.

164) If the electric current is passed through a nerve, the man is excited, why?

165) A steady current is flowing in a cylindrical conductor. Is there any electric field within the conductor?

166) How can you keep a constant current inside a conductor?

167) How does the drift velocity of electrons in a metal conductor vary with the increase in temperature?

168) If the temperature of a good conductor increases, how does the relaxing time of electrons in the conductor change?

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

170) The connecting wires are of copper. Why?

171) The current i flows in a wire of circular cross-section with the free electrons travelling with a drift velocity v. What is the drift velocity of electrons when a current of 2i flows in another wire of twice the radius and of the same material?

172) Two conducting wires X and Y of diameter ratio 2 : 1 but different materials are joined in series across a battery. If number density of electrons in X is twice that in Y, find the ratio of drift velocity of electrons in the two wires.

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

174) What should be the properties of standard resistances?

175) What are the materials generally used for making standard resistances? Give their compositions.

176) The specific resistance of copper, silver and constantan are 1.78 x 10^{-6} Ω-cm, 10^{-6} Ω-cm and 48 x 10^{-6} Ω-cm, respectively. Which is the best conductor and why?

177) What are Non-ohmic devices? Give examples.

178) Name three materials whose resistivity decreases with rising in temperature.

179) Is the formula V = IR true for non-ohmic devices also?

180) A 4 Ω non-insulated resistance wire is bent in the middle by 180^{o} and both the halves are twisted with each other. What will be its new resistance?

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

182) The current flowing through a conductor is 2 mA at 50 V and 3 mA at 60 V. Is it an ohmic or nonohmic conductor?

183) It is easier to start a car engine on a warm day than on a chilly day. Why?

184) What is the order of magnitude of the resistance of a (dry) human body?

185) If potential difference V applied across a conductor is increased by 2 V, how will the drift velocity of the electrons change?

186) Alloys of metals have a greater resistivity than that of their constituent metals. Why?

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

188) What is the resistance of carbon resistor on which the colour of rings in sequence is black, brown, black and gold.

189) What will be the bands of colours in sequence on carbon resistor, if its resistance is $0.1\Omega \pm 5$ %

190) What is the colour code for a resistor of resistance $3.5\ k\Omega$ with 5% tolerance?

191) What is the most probable cause of superconductivity?

192) What are the conditions required for making a conductor as a super conductor?

193) Of metals and alloys, which has a greater value of temperature coefficient of resistance?

194) Explain why resistance becomes more in series combination.

195) Explain why resistance becomes less in parallel combination.

196) Join three resistance of $2\ \Omega$ each such that the total resistance of the circuit is $3\ \Omega$.

197) What is the difference between electromotive force and a terminal voltage of a cell? How are they related to each other?

198) What is the internal resistance of a cell due to?

199) On increasing the current drawn from a cell, the potential difference of its terminals is lowered. Why?

200) Can the terminal potential differences of a cell exceed its e.m.f?

201) A (i) series (ii) parallel combination of two given resistors is connected one by one across a cell. In which case will the terminal potential difference across the cell have a higher value?

202) Two identical cells each of emf ϵ, having negligible internal resistance r, are connected in parallel with each other across an external resistance R. What is the current through this resistance.

203) Write any two factors on which internal resistance of a cell depends.

204) The car battery is 12 volts. 8 simple cells connected in series can give 12 volt. But such cells are not used in starting a car; why?

205) When cells are connected in parallel, what will be the effect on
(i) current capacity
(ii) e.m.f of the cells.

206) Is it possible that there is no potential difference between the plates of a cell? If yes, under what condition?

207) A parallel combination of two cells of EMFs ϵ_1 and ϵ_2 , and internal resistances r $_1$ and r_2 is used to supply current to a load of resistance R. Write the expression for the current through the load in terms of ϵ_1 , ϵ_2 , r_1 and r_2.

208) How is the current conducted in metals? Explain.

209) A conductor of length L is connected to a dc source of emf ϵ. If this conductor is replaced by another conductor of the same material and same area of cross-section but of length 3 L, how will the draft velocity change?

210) If the current flowing in a copper wire be allowed to flow in another copper wire of the same length but of double the radius, then what will be the effect on the drift velocity of the electrons. If the same current is allowed to flow in an iron wire of the same thickness, then?

211) Write the mathematical relation between mobility and drift velocity between mobility and drift velocity of charge carriers in a conductor. Name the mobile charge carriers responsible for conduction of electric current in (a) an electrolyte (b) an ionised gas.

212) If the resistance of our body is so large ($\approx 10\ k\Omega$) why does one experience a strong shock when one accidently touches the line wire, say a 240 volt supply?

213) There is an impression among many people that a person touching a high power line gets stuck with the line. Is that true? Explain.

214) Currents of the order of 0.1 A through the human body are fatal. What causes the death: heating of the body due to electric current or something else?

215) While making a standard resistance, the coil is made of manganin. The coil is double folded and is wound over a non-conducting frame. Why?

216) The V-I graph for a conductor makes an angle θ with V-axis. Here V denotes voltage and I denotes current. What is the resistance of this conductor?

217) Define the units of conductance and conductivity. Give their dimensional formulae.

218) Three materials A, B and C have electrical conductivities $\sigma,\ 2\ \sigma\ and\ 2\ \sigma$ respectively. Their number densities of free electrons are 2 n, n and 2 n respectively. For which material is an average collision time of free electrons maximum?

219) Explain how electron mobility changes for a good conductor, when
(i) the temperature of the conductor is decreased at the constant potential difference and
(ii) applied potential difference is doubled at a constant temperature.

220) Two wires A and B are formed from the same material with the same mass. The diameter of wire A is half of diameter of wire B. If the resistance of wire A is 32 Ω , find the resistance of wire B.

221) A wire is drawn into double its length and half its original cross-section. What will increase in its
(i) resistance and
(ii) resistivity?

222) Two students A and B were asked to pick a resistor of $15\ k\Omega$ from a collection of carbon resistors. A picked a resistor with bands of colours: brown, green, orange while B choose a resistor with bands black, green, red. Who picked the correct resistor? Explain.

223) A voltage of 200 V is applied across a colour-coded carbon resistor with first, second and third ring of blue, black and yellow colours. What is the current flowing through the resistor?

224) What are thermistors? Explain their use in brief.

225) Thermistors differ from ordinary resistors. Explain.

226) What are superconductors? Write their two applications.

227) A carbon filament has a resistance of $100\ \Omega$ at 0°C. What must be the resistance of copper filament placed in series with carbon so that the combination has the same resistance at all temperatures? Temperature coefficient of resistance of carbon = -0.0007 $^oC^{-1}$ and that of copper is 0.004 $^oC^{-1}$.

228) A uniform wire is cut into four segments. Each segment is twice as long as the earlier segment. If the shortest segment has a resistance of $2\ \Omega$, find the resistance of original wire.

229) Why is it unsafe to turn a light switch on or off while taking bath?

230) Lights of a car become dim when the starter is operated. Why?

231) To reduce the brightness of a light bulb, should an auxiliary resistance be connected in series withy it or in parallel?

232) An electric current is passed through a circuit containing two wires of the same material connected in parallel. If the length and radii of the wires are in the ratio 2/3 and 4/3, then find the ratio of the currents passing through the wires.

233) At 0°C, the resistance of a conductor B is n times that of conductor A. The temperature coefficients of resistance of A and B are α_1 and α_2 respectively. For the series combination of the two conductors find (a) the resistance at 0°C (b) the temperature coefficient of resistance.

234) What is terminal potential difference of a cell? Can its value be greater than the emf of a cell? Explain.

235) A car has a fresh storage battery of emf 12 V and internal resistance $5.0 \times 10^{-2}\ \Omega$. If the starter motor draws a current of 90 A, what is the terminal voltage of the battery when the starter is on?

236) After long use of car, as given in question 33, the internal resistance of the storage battery increases to $500\ \Omega$. What maximum current can be drawn from the battery? Assume the emf of the battery to remain unchanged.

237) Three identical cells each of emf 2 V and unknown internal resistance are connected in parallel. This combination is connected to a 5 ohm resistor. If the terminal voltage across the cells is 1-5 volt, what is the internal resistance of each cell?

238) For what basic purpose the cells are connected
(i) in series
(ii) in parallel and
(iii) in mixed grouping?

239) Are Kirchhoff's rules applicable to both a.c. and d.c.?

240) State the fundamental concepts on which two Kirchhoff's rules are based.

241) What is the principle of working of meter bridge?

242) When is a Wheatstone bridge said to be balanced?

243) What happens to the balance point if the position of the cell and the galvanometer are interchanged in balanced Wheatstone bridge?

244) At what position of the jockey on slide wire bridge, the results are most accurate?

245) Why is a meter bridge also called a slide wire bridge?

246) When is Wheatstone Bridge most sensitive?

247) What are two practical forms of Wheatstone bridge?

248) In a metre bridge, the length of the wire is 100 cm. At what position will the balance point be obtained if the two resistances are in the ratio 1 : 3?

249) What do you mean by sensitiveness of a Wheatstone bridge?

250) Why is meter bridge method not suitable for measuring high resistances.

251) State the principle of working of a potentiometer.

252) Why is a potentiometer named as potentiometer?

253) Why should the potentiometer wire be of uniform cross-section and composition?

254) Can we use copper wire as potentiometer wire? Explain.

255) Of which material is a potentiometer wire normally made and why?

256) Explain, why should the current be not passed through potentiometer wire for long time?

257) The emf of the driving cell used in the main circuit of the potentiometer should be more than the potential difference to be measured. Why?

258) Some times balance point may not be obtained on the potentiometer wire. Why?

259) Whether electric field inside potentiometer wire is constant or variable?

260) Why do we prefer a potentiometer to measure emf of a cell rather than a voltmeter?

261) How can you make a potentiometer of given wire length more sensitive using a resistance box?

262) Why do we prefer a potentiometer with a longer bridge wire?

263) What should be the properties of the material for the selection of potentiometer wire?

264) It is advised that the jockey is not to be rubbed on potentiometer wire while using it?

265) Kirchhoff's first rule obeys law of conservation of charge. Explain.

266) Is it necessary to keep the length of the slide bridge wire 1 metre? Explain.

267) Why should the area of cross-section of the meter-bridge wire be uniform? Explain.

268) What is the end error in meter bridge? How do you remove it?

269) Why are the connecting resistors in a metre bridge made of thick copper strips?

270) Why is the meter bridge method considered unsuitable for the measurement of very low resistances?

271) What are the advantages of a Wheatstone bridge method of measuring resistance over other methods?

272) Can you express the potential gradient in terms of specific resistance of the wire? If yes, find the relation.

273) What is the unit of potential gradient? If the potential gradient along the potentiometer wire be decreased, will the zero-deflection position be obtained at longer length or shorter length?

274) If the emf of the driving cell be decreased, what will be effect on the position of zero deflection in a potentiometer? Explain.

275) If the length of the wire be (i) doubled and (ii) halved, what will be effect on the position of zero deflection in a potentiometer? Explain.

276) If the current flowing in the wire of the potentiometer be decreased, what will be effect on the position of zero deflection in potentiometer? Explain.

277) How can you make a potentiometer of a given length more sensitive by using a resistance box?

278) What is the law that defines heat produced by an electric current?

279) 100 W, 220 V bulb is connected to 110 V source. Calculate the energy consumed (in unit of electricity) by the bulb in 1 hour.

280) The coil of a heater is cut into two equal halves and only one of them is used in heater. What is the ratio of the heat produced by this half coil to that by the original coil?

281) Name the physical quantity which has its unit joule coulomb^{-1}. Is it a scalar or vector quantity?

282) An ammeter reads a current of 30 A when it is connected across the terminals of a cell of emf 2 V. Neglecting the meter resistance, find the amount of heat (in calories) in cell in 20 seconds.

283) What do you understand by maximum power rating of a resistor?

284) Which has greater resistance: 1 k W electro heater or a 100 W filament bulb, both marked for 220 V?

285) Two resistors of $2\ \Omega$ and $4\ \Omega$ are connected in parallel to a constant d.c. voltage. In which case more heat is produced?

286) Distinguish between kilowatt and kilowatt hour.

287) 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?

288) Write an expression for the heat produced when an electric current is passed through it.

289) What is the meaning of 1 unit electric energy in domestic use?

290) How many joules of energy is equivalent to 1k Wh?

291) What is the no. of kWh in 1 joule?

292) If the current in the electric bulb changes by 1 %, then by what percentage will the power change?

293) A current in a circuit having constant resistance is tripled. How does this affect the power dissipation?

294) Two identical heaters rated 220 V, 1500 W each are placed in series with each other across a 220 V. What is the total power of combination?

295) What is the difference between heater wire and fuse wire?

296) What is the safest voltage you can safely put across a 98 Ω , 0.5 W resistor?

297) Three bulbs 40 W, 60 W and 100 W are connected in series to 220 V 4 mains. Which bulb will glow brightly?

298) What is the material of the element used in an electric heater?

299) What is the composition of materials used in the fuse wire?

300) State the characteristics of fuse wire.

301) What do you mean by specification of a bulb or other electric appliances?

302) The temperature of the filament of an electric bulb is 2700^{o}C when it glows. It is not burnt up at such a high temperature. Why?

303) Why an electric bulb becomes dim when an electric heater in parallel circuit is switched on? Why dimness decreases after some time?

304) The two electric bulbs of same power are connected in parallel circuit. If one bulb is glowing and then another bulb is switched on, then brightness of the first bulb increases, decreases or remains unchanged. Explain.

305) Three identical resistors, each of resistance R, when connected in series with a d.c. source, dissipate power X. If the resistors are connected in parallel to the same d.c. source, how much power will be dissipated?

306) The rate of Joule heat is given by P = V x I where V is the potential difference across the ends of a conductor and I is the current flowing through it. Does this relation hold for a conductor that does not obey Ohm's law?

307) Two bulbs of same wattage, one having a carbon filament and the other having a metallic filament, are connected in series to the mains. Which one will glow more?

308) Current is allowed to flow in a metallic wire at a constant potential difference. When the wire becomes hot, cold water is poured on half portion of the wire. By doing so, its other portion becomes still more hot. Explain its reason.

309) Two wires A and B of the same material and having same length, have their cross-sectional areas in the ratio 1 : 4. What should be the ratio of heat produced in these wires when same voltage is applied across each?

310) Two heater wires of equal length are first connected in series and then in parallel. Find the ratio of heat produced in the two cases.

311) An electric kettle has two coils. When one of these is switched on, the water in the kettle boils in 6 minutes. When the other coil is switched on, the water boils in 3 minutes. If the two coils are connected in series, find the time taken tp boil the water in the kettle.

312) In question no. 10, if the two coils are connected in parallel, find the time taken to boil the water in the kettle.

313) Under what condition is the heat produced in an electric circuit:
(i) directly proportional
(ii) inversely proportional to the resistance of the circuit?

314) A boy has two wires of iron and copper of equal length and diameter. He first joins the two wires in series and passes electric current through this combination which increases gradually with time. After that he joins them in parallel and repeat the process of passing the current in this arrangement also. Which wire will glow first in each case and why?

315) In an electric kettle, water boils in 10 minutes after the kettle is switched on. With the same supply voltage if the water is to be boiled in 8 minutes, should the length of the heating elements be increased or decreased? Explain.

316) Two bulbs of resistances $40\ \Omega$ and $400\ \Omega$ are in series in a circuit fed with supply current. Which one will glow more? If one of these bulbs be switched off, will the light in the room increase or decrease?

317) A heater joined in series with a 100 watt bulb is connected to the mains. If the 100 watt bulb is replaced by a 50 watt bulb, then will the heater now give more heat, less heat or same heat? Why?

318) Of the bulb in a house, one glows brighter than the other, which of the two has a large resistance.

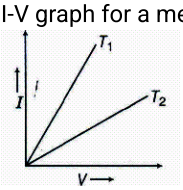
319) Two electric bulbs of 50W are 100W are given. When they are
(i) connected in series
(ii) connected in parallel, which bulb will glow more?

320) What is the difference between heating wire and fuse wire?

321) An immersion heater is rated 836 watt. In what time, it should heat 1 litre of water from 20^oC to 40^o C? J = 4.18 J/cal.

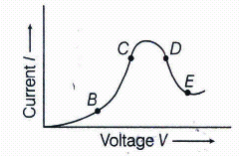
322) A household circuit has a fuse of 5 A rating. Calculate the maximum number of bulbs of rating 60 W - 220 V each which can be connected in this household circuit.

323) I-V graph for a metallic wire at two different temperature T_1 and T_2 is as shown in the figure below.



Which of the two temperatures is lower and why?

324) Graphing showing the variation of current versus voltage for material Gaas is shown in the figure. Identify the region of



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

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

326) Is the motion of a change across junction momentum conserving? Why or why not?

327) In an experiment of meter bridge, the balancing length of the wire is l. What would be its value, if the radius of the meter bridge wire is double? Justify your answer.

328) A negligible small current is passed through a wire of length 20 m and uniform cross-section $3 \times 10^{-7} m^2$ and its resistance is measured to be 2Ω . What is the resistivity of the material at the temperature of the experiment?

329) The emf of a cell is always greater than its terminal voltage. Why?

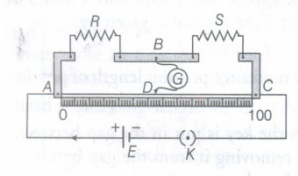
330) In a meter bridge, two unknown resistances R and S, when connected between the two gaps, give a null point at 40 cm from one end. What is the ratio of R and S?

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

332) 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 the circuit.

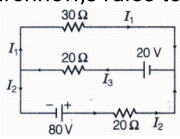
333) (i) You are required to select a carbon resistor of resistance $47K\Omega \pm 10$ % from a large collection. What should be the sequence of colour bands used to code it?
(ii) Write two characteristics of manganin which make it suitable for making standard resistances.

334) In a meter bridge, the null point is found at a distance of 33.7 cm from A. If 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.

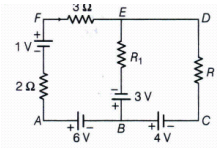


335) when is more power delivered to a light bulb, just after it is turned on and the glow of the filament is increasing or after it has been ON for a few seconds and the glow is steady?

336) Use Kirchhoff,s rules to determine the value of the current I_1 flowing in the circuit shown in the figure.

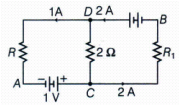


337) Use Kirchhoff's rules to determine the potential difference between the points A and D. When no current flows in the arm BE of the electric network shown in the figure below.

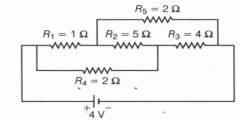


338) A cell of emf E and internal resistance r is connected across a variabl resistor R. Plot a graph showing variation terminal voltage V of the cell versus the current I. Using the plot, show how emf of the cell and its internal resistance can be determined.

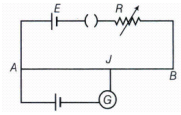
339) In the given circuit, assuming point A to be at zero potential, use Kirchhoff,s rules to determine the potential at point B.



340) Calculate the current drawn from the battery in the given network.



341) AB is a potentiometer wire as shown in figure. If the value of R is increased, in which direction will the balance point J shift?



342) Name the colours corresponding to the digits 4 and 7 in the colour code scheme for carbon resistors.

343) Write the expression for the drift velocity of charge carriers in a conductor of length / across which a potential difference V is applied.

344) How does one explain increase in resistivity of a metal with increase in temperature?

345) Why is the terminal voltage of a cell less than its emf?

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

347) 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 that in Y, find the ratio of drift velocity of electrons in the two wires.

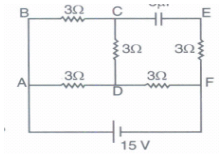
348) Draw a plot showing the variation of resistivity of a (i) conductor and (ii) semiconductor, with the increase in temperature. How does one explain this behaviour in terms of number density of charge carriers and the relaxation time?

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

350) A cell of emf 'E' and internal resistance 'r' is connected across a variable resistor 'R'. Plot a graph showing variation of terminal voltage 'V' of the cell versus the current 'I'. Using the plot, show how the emf of the cell and its internal resistance can be determined.
Draw the plots of the terminal voltage V versus (i) R and (ii) the current I

351) Estimate the average drift speed of conduction electrons in a copper wire of cross-sectional area 1.0 x10^{-7} m^2 carrying a current of 1.5 A. Assume the density of conduction electrons to be 9 x 10^{28} m^{-3}.

352) In the circuit shown in the figure, find the total resistance of the circuit an d the current in the arm CD.



353) Draw a graph showing variation of resistivity with temperature for nichrome. Which property of nichrome is used to make standard resistance coils?

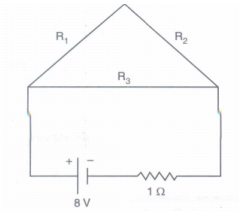
354) A battery of emf E and internal resistance, r, when connected an external resistance of 12 n produces a current of 0.5 A. When connected across a resistance of 25Ω, it produces a current of 0.25 A. Determine (i) the emf and (ii) the internal resistance of the cell.

355) 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 Rl only
(iii) with R, and R_2 in series combination
(iv) with R_1 and R_2 in parallel combination. The currents measured in the four cases are 0.42A, 1.05 A, 1.4 A and 4.2 A, but not necessarily in that order. Identify the currents corresponding to the four cases mentioned above.

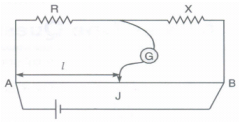
356) Two heating elements of resistance R_1 and R_2 when operated at a constant supply of voltage, V, consume powers P_1 and P_2 respectively. Deduce the expressions for the power of their combination when they are, in turn, connected in
(i) series and
(ii) parallel across the same voltage supply.

357) State Kirchhoff's rules. Explain briefly how these rules are justified.

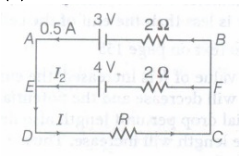
358) A uniform wire of resistance 12 Ω is cut into three pieces so that the ratio of the resistances R_1: R_2: R_3 = 1 : 2 : 3 and the three pieces are connected to form a angle across which a cell of emf 8 V and internal resistance 1Ω is connected as shown. Calculate the current through each part of the circuit.



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

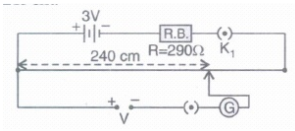


360) Using Kirchhoff's rules in the given circuit, determine
(i) the voltage drop across the unknown resistor R and
(ii) the current I in the arm EF.

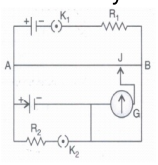


361) State the underlying principle of a potentiometer.

362) Calculate the value of the unknown potential V for the given potentiometer circuit. The total length (400 cm) of the potentiometer wire has a resistance of 10 Ω and the balance point is obtained at a length of 240 cm



363) For the circuit shown here, would the balancing length increase, decrease or remain the same, if
(i) R_1 is decreased;
(ii) R_2 is increased;
without any other change, (in each case) in the rest of the circuit. Justify your answers in each case.



364) Why is adsorption always exothermic?

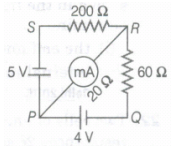
365) Out of physisorption or chemisorption, which has higher enthalpy of adsorption?

366) (i) State the law which helps to determine the limiting molar conductivity of the weak electrolyte.
(ii) Calculate limiting molar conductivity of $CaSO_4$

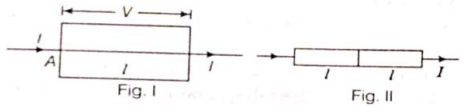
367) A wire of resistance 8R is bent in the form of a circle. What is the effective resistance between the ends of a diameter AB?

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

369) 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 Millimetre.



370) 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?



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

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

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

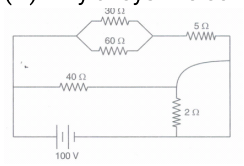
374) A conductor of length l is connected to a DC source of potential V. If the length of the conductor is tripled by gradually stretching it, keeping V constant, how will
(i) drift speed of electrons and
(ii) resistance of the conductor be affected? Justify your answer.

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

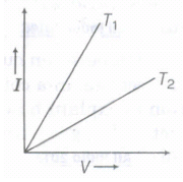
376) Derive an expression for drift velocity of free electrons in a conductor in terms of relaxation time.

377) Derive an expression for drift velocity of free electrons.
How does drift velocity of electrons in a metallic conductor vary with increase in temperature? Explain

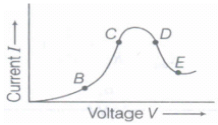
378) (i) Define the term of drift velocity.
(ii) On the basis of electron drift, derive an expression for resistivity of a conductor in terms of number density of free electrons and relaxation time. On what factors does resistivity of a conductor depend?
(iii) Why alloys like constantan and manganin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



379) 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?



380) 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.

381) Plot a graph showing variation of current versus voltage for the material GaAs.

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

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

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

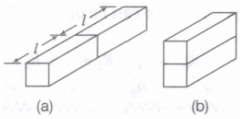
385) Write a relation between current and drift velocity of electrons in a conductor. Use this relation to explain how the resistance of a conductor changes with the rise in temperature?

386) 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.

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

388) Define resistivity of a conductor. Write its SI unit.

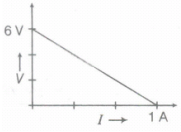
389) Two identical slabs, of a given metal, are joined together, in two different ways, as shown in figures (a) and (b).



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

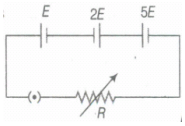
390) The three coloured bands, on a carbon resistor are red, green and yellow, respectively. Write the value of its resistance.

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

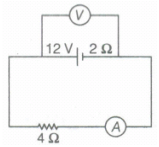


392) A cell of emf E and internal resistance r draws a current I. Write the relation between terminal voltage V in terms of E, I and r.

393) 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.



394) A battery of emf 12 V and internal resistance 2Ω is connected to a 4Ω 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?

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

396) 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.

397) A cell of emf E and internal resistance r is connected across a variable resistor R. Plot a graph showing the variation of terminal potential V with resistance R. Predict from the graph, the condition under which V becomes equal to E.

398) Plot a graph showing the variation of terminal potential difference across a cell of emf E and internal resistance r with current drawn from it. Using this graph, how does one determine the emf of the cell?

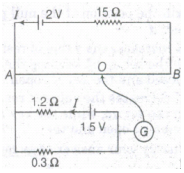
399) Nichrome and copper wires of same length and same radius are connected in series. Current I is passed through them. Which wire gets heated up more? Justify your answer.

400) 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.

401) In a meter bridge, two unknown resistances Rand 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?

402) Use Kirchhoff's rules to obtain the balance conditions in a Wheatstone bridge.

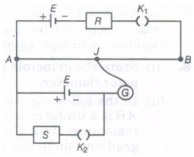
403) In the following potentiometer, circuit AB is a uniform wire of length 1m and resistance 10n. Calculate the potential gradient along the wire and balance length AO(l)



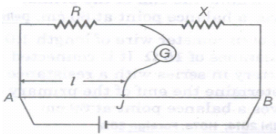
404) An ammeter of resistance 0.80Ω can measure current up to 1.0A.
(i) What must be the value of shunt resistance to enable the ammeter to measure current up to 5.0 A ?
(ii) What is the combined resistance of the ammeter and the shunt?

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

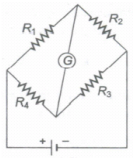
406) Two students X and Y perform an experiment on potentiometer separately using the circuit given below. Keeping other parameters unchanged, how will the position of the null point be affected, if
(i) X increases the value of resistance R in the set up by keeping the key K_1 closed and the key K_2 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?



407) 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?



408) For the circuit diagram of a Wheatstone bridge shown in the figure, use Kirchhoff's laws to obtain its balance condition

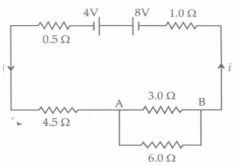


409) Obtain the formula for the power loss (i.e. power dissipated) in a conductor of resistance R, carrying a current

410) Give an example of a material each for which temperature coefficient of resistivity is (i)positive, (il) negative.

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

412) In the circuit shown in the figure, find the current through each resistor.

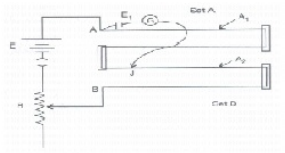


413) Why is potentiometer preferred over a voltmeter for determining the emf of a cell?

414) The temperature coefficient of resistivity, for two materials A and B, are 0.0031 rc and 0.0068 / °C respectively. Two resistors R_1 and R_2 t made from materials A and B, respectively, have resistances of 200^0 and 100 0 at 0°C. Show on a diagram, the 'colour code', of a carbon resistor, that would have a resistance equal to the series combination of R_1 and R_2 t at a temperature of 10^oC. (Neglect the ring corresponding to the tolerance of the carbon resistor).

415) Draw a circuit diagram of a potentiometer. State its working principle. Derive the necessary formula to describe how it is used to compare the emfs of the two cells.

416) You are given two sets of potentiometer circuit to measure the emf E_1 of a cell
Set A: consists of a potentiometer wire of a material of resistivity ρ_1 area of cross section A_1 and length l.
Set B : consists of a potentiometer of two composite wires of equal lengths l_2 each, of resistivity ρ_1 , ρ_2 and area of cross-section A_1, A_2 respectively.
(i) Find the relation between resistivity of the two wires with respect to their area of cross section, if the current flowing in the two sets is same.
(ii) Compare the balancing length obtained in the two sets.



417) Magnesium is used for making standard resistors, Why?

418) The Sequence of bands marked on a carbon resistor are: Red, Red, Red, Silver, Write the value of resistance with tolerance.

419) (i) A wire of resistivity p is stretched to three times its length. What will be its new resistivity?
(ii) In what manner do the relaxation time in the good conductor change when its temperature increases?

420) If p.d.v applied across a conductor is increased to 2v, how will the draft velocity of the electrons change?

421) A 10Ω thick wire is stretched so that its length becomes three times. Assuming that there is no change in its density on stretching. Calculate the resistance of new wire

422) You are given 8 Ω resistor. What length of wire of resistance 120 Ωm-1 should be joined in parallel with it to get a value of 6 Ω ?

423) Three resistance 3Ω, 6Ω and 9Ω are connected to a battery. In which of them will the power dissipation be maximum if
a) They are all connected in parallel
b) They are all connected in series Give reason.

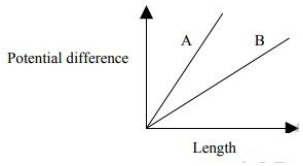
424) Give any two applications super conductors

425) Two wire of equal length one copper and manganin have same resistance , which wire is thicker?

426) Why manganin is used for making standard resistor?

427) A copper wire of resistivity ρ is stretched to reduce its diameter to half of its previous value. What will be the new resistances?

428) The variation of potential difference with length incase of two potentiometres A and B is given below.Which of the two is more sensitive



429) If the temperature of the conductor increases, how does the relaxation time of electron changes

430) If the length of the wire conductor is doubled by stretching it, keeping potential difference constant by what factor the drift speed of the electron changed.

431) A heater joined in series with the 60W bulb. With change of bulb with 100 W in the circuit, the rate heat produce by the heater will more or less or remain same

432) What will be the change in the resistance of the circular wire, when its radius is halved and length is reduced by $1/4^{th}$ of original length.

433) Two 120V light bulbs, one of 25W and another of 200W are connected in series. One bulb burnt out almost instantaneously? Which one was burnt and why?

434) A given copper wire is stretched to reduce its diameter is half of its original value.What will the new resistance?

435) A student has two wire of iron and copper of equal length and diameter. He first joins two wires in series and pass electric current through the combination which increases gradually. After that he joins two wires in parallel and repeats the process of passing current. Which wire will glow first in each case?

436) A cylindrical metallic wire is stretched to increase its length by 5%. Calculate the percentage change in resistances.

437) A wire of resistance 4R is bend in the form of circle. What is the effective resistance between the ends of diameter?

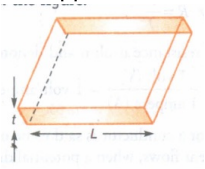
438) Two wires A and B have same lengths and material, have their cross sectional areas 1:4, what would be the ratio of heat produced in these wires when the voltage across each is constant

439) Two bulbs whose resistance are in the ratio of 1:2 are connected in parallel to a source of constant voltage. What will be the ratio of power dissipation in these?

440) Total resistance of the circuit is R/3 in which three identical resistors are connected in parallel. Find the value of each resistance?

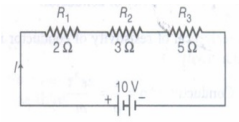
441) In a potentiometer arrangement, a cell of emf 1.25 V gives a balance point at 35.0 cm length of the wire. If the cell is replaced by another cell and the balance point shifts to 63.0 cm, what is the emf of the second cell?

442) Consider a thin square sheet of side Land thickness t, made of a material of resistivity p. The resistance between two opposite faces, shown by the shaded areas in the figure.



443) Two conductors are made of the same material and have the same length. Conductor A is a solid wire of diameter 1 mm. Conductor B is a hollow tube of outer diameter 2 mm and inner diameter 1mm. Find the ratio of resistance R_A to R_B.

444) In the figure given below, the three resistors with resistances 2 Ω, 3 Ω and 5 Ω respectively, are connected in series with 10 V battery. Calculate the equivalent resistance and current that passes through each resistor in the given network.



445) How should a group of resistances be connected, so that same current flows through all of them?

446) Name the unit of electric energy used for domestic purpose.

447) What is the commercial unit of electrical energy and how is it related to joules?

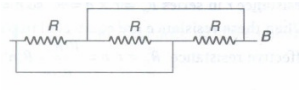
448) A wire of 2 Ω is halved and the two pieces are joined in parallel. Find its resistance.

449) If a wire of 4 Ω resistance is doubled on itself with its two ends joined, then what is the new resistance?

450) 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?

451) A wire of resistance 6R is bent in the form of a circle. What is the effective resistance between the ends of the diameter?

452) Find the equivalent resistance between points A and B of the circuit given below.

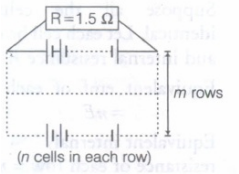


453) Give n resistors each of resistance R, how will you combine them to get
(i) maximum
(ii) minimum effective resistance?

454) The current through a resistance R ohm is 1A. If another resistance of R ohm is connected in parallel with it, then what will be the amount of current flowing through the first resistance?

455) 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.

456) 12 cells, each of emf 1.5 V and internal resistance of 0.5 Ω, are arranged in m rows each containing n cells connected in series, as shown in the figure. Calculate the values of n and m for which this combination would send maximum current through an external resistance of 1.5 Ω.



457) Which of the two emf E or potential difference V of a cell, is greater and by how much?

458) First a set of n equal resistors of R each are connected in series to a battery of emf E and internal resistance R and current I is observed to flow. Then, the resistors are connected in parallel to the same battery. It is observed that the current is increased 10 times. What is n?

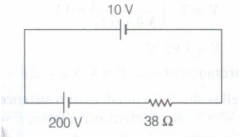
459) Write the relation between emf and potential difference for a cell. What are their respective units?

460) What is the difference between the values of potential difference across the two terminals of a cell in an open circuit and closed circuit?

461) 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.

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

463) 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.



464) State Kirchhoff's first law.

465) State Kirchhoff's second law.

466) When a Wheatstone bridge is most sensitive?

467) Write one reason for end error in a meter bridge.

468) 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.

469) What is the significance of direction of electric current?

470) Describe how the resistivity of the conductor depends upon
(i) number density (n) of free electrons and
(ii) relaxation time (τ),

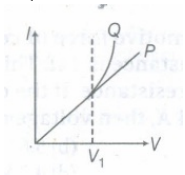
471) Two conducting wires A and B of the same length but of different materials are joined in series across a battery. If the number density of electrons in A is twice than that in B, find the ratio of drift velocities of electrons in two wires.

472) One what basic conservation laws, are Kirchhoff's laws based?

473) We prefer a potentiometer with a longer bridge wire. Explain? why?

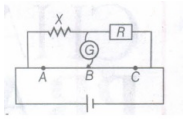
474) By using a resistance box, how can you make a potentiometer of given wire length more sensitive?

475) Figure below shows a plot of current versus voltage for two different materials P and Q. Which of the two materials satisfies Ohm's law?
Explain

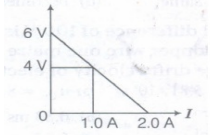


476) Car batteries are often rated in unit ampere hours. Does this unit designate the amount of current, energy, power or charge that can be drawn from the battery? Explain

477) R_1, R_2 and R_3 are three different values of resistor R. Such that $R_1 > R_2 > R_3$. A, B and C are the null points obtained corresponding to R_1, R_2 and R_3, respectively. For which resistor, the value of X will be most accurate and why?



478) The figure shows a plot of terminal voltage V versus the current I of a given cell.
Calculate from the graph
(i) emf of the cell.
(ii) internal resistance of the cell.



479) A ware of 20 Q resistance is gradually stretched to double its original length. It is then cut into two equal parts. These parts are then connected in parallel across a 4.0 V battery. Find the current drawn from the battery.

480) The emf of a battery is 2V and its internal resistance is 2 Ω. Its potential difference is measured by a voltmeter of resistance 998 Ω. Calculate the percentage error in the reading of emf shown by the voltmeter.

481) 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?

482) 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, drift speed and electric field?

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

484) 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?

485) Is there a net field inside the cell when the circuit is closed and a steady current passes through? Explain.

486) 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?

487) Two similar wires of same length and same area of cross-section but of different material, having resistivity P1 and P2 are connected end to end (in series). Calculate the effective resistivity of their combination.

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

489) You are given three constantan wires P, Q and R of length and area of cross-section (L, A), $\left(2L, \frac{A}{2}\right)$, $\left(\frac{L}{2}, 2A\right)$ respectively. Which has highest resistance?

490) Two similar wires of same length and same area of cross-section but of different material having resistivity P_1 and P_2 are connected side by side i.e. in parallel. Calculate the effective resistivity of their combination.

491) State the condition under which the terminal potential difference across a battery and its emf are equal.

492) A car battery is of 12 V. Eight dry cells of 1.5 V connected in series also give 12 V, but such a combination is not used to start a car. Why?

493) A cell of negligible internal resistance is connected in series to the wire of a potentiometer. If potentiometer wire is changed and in its place another wire of different material having diameter twice of the first wire is used keeping the length constant, then how the balance point will change?

494) How can we increase the sensitivity of a potentiometer?

495) Why is the potentiometer preferred to a voltmeter for measuring emf of a cell?

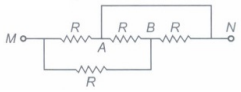
496) Why copper is not used for making potentiometer wires?

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

498) Define mobility of electron in a conductor. How does electron mobility change when
(i) temperature of conductor is decreased and
(ii) applied potential difference is doubled at constant temperature?

499) Nichrome and copper wires of same length and area of cross section are connected in series, current is passed through them why does the nichrome wire get heated first?

500) Calculate the resistance across the points M and N in the given figure.



501) If a wire of resistance R is stretched to n times, without affecting resistivity, and then it is cut into n equal parts. Now, all the parts are connected in parallel, what will be the new resistance?

502) A uniform wire of resistance R ohm is bent into a circular loop as shown in the figure. Compute effective resistance between diametrically opposite points A and B.

503) Why a conductor heats up when electric current is passed through it?

504) Distinguish between the emf and the potential difference across a cell.

505) State the two Kirchhoff's rules used in electric networks. How are these rules justified?

506) Five identical cells, each of emf E and internal resistance r, are connected in series to form (a) an open (b) a closed circuit. If an ideal voltmeter is connected across three cells, what will be its reading?

507) For two nichrome wires connected in series with a battery, how does the ratio of drift velocity of electrons in them depend on their (a) lengths and (b) diameters.

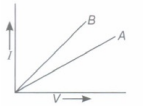
508) State the principle on which the working of a meter bridge is based. Under what condition is the error in determining the unknown resistance minimised?

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

510) In the figure, what is the potential difference between A and B?

511) Why do bends in a wire not affect its resistance?

512) Out of V-I graph for parallel and series combination of two metallic resistors, which one represents parallel combination of resistors? Justify your answer



513) Sketch a graph showing variation of resistivity of carbon with temperature.

514) Define drift velocity. Write its relationship with relaxation time in terms of the electric field $\vec{E}$ applied to a conductor.

515) Name two factors on which the resistivity of a given material depends.
A carbon resistor has a value of 62 kΩ with a tolerance of 5%. Give the colour code for the resistor.

516) Wheatstone bridge method is considered unsuitable for the measurement of very low resistances. Why?

517) A negligible small current is passed through a wire length 15 m and uniform cross-section 6 x $10^{-7}m^2$ and its resistance is measured to be 5 Ω .What is the resistivity of the material at the temperature of the experiment?

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

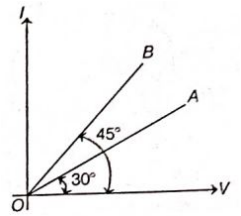
519) Define the conductivity of a conductor. Write its SI unit.

520) 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?

521) How is the drift velocity in a conductor affected with the rise in temperature?

522) Two electric heaters have power ratings P_1 and P_2, at voltage V. They are connected in series to a DC source of voltage V. Find the power consumed by the combination. Will they consume the same power, if connected in parallel across the same Source?

523) Two wires A and B of different metals have their lengths in ratio 1 : 2 and their radii in ratio 2 : 1, respectively. I - V graphs for them is shown in the figure.



Find the ratio of their
(i) Resistances (R_A/ R_B) and
(ii) Resistivities (σ_A/σ_B)

524) Find the temperature at which the resistance of a conductor increases by 25% of its value at 27°C. The temperature coefficient of resistance of the conductor is 2.0 $\times$ 10^{-4}°C^{-1}.

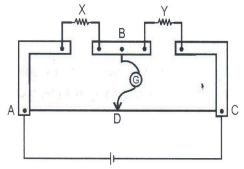
525) At room temperature (27.0°C) the resistance of a heating element is 100 Ω . What is the temperature of the element if the resistance is found to be 117Ω given that the temperature coefficient of the material of the resistor is 1.70 x 10^{-4} °C^{-1}.

526) A silver wire has a resistance of 2.1Ω at 27.5°C and a resistance of 2.7Ω at 100°C. Determine the temperature coefficient of resistivity of silver.

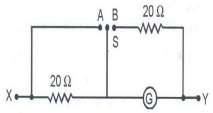
527) The number density of free electrons in a copper conductor estimated is $8.5 \times 10^{28} m^{-3}$. How long does an electron take in drifting from one end of a wire 3.0m long to its other end? The area of cross-section of the wire is $2.0 \times 10^{-6} m^2$ and it is carrying a current of 3.0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

528) An electric toaster uses nichrome for its heating element. When a negligibly small current passes through it, its resistance at room temperature (27.0 °C) is found to be 75.3 Ω. 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 x 10^{-4} °C^{-1}.

529) (a)In a meter bridge shown below 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 above 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?

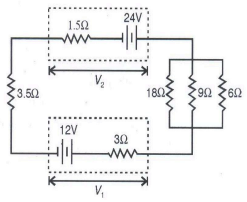


530) The galvanometer in the circuit shown here has a resistance of 20Ω The terminals X and Y are connected to a cell of e.m.f. 1.5V and internal resistance 10Ω Calculate the current flowing in the galvanometer:
(i) When the switch S is in position.
(ii) When the switch S is in position B.



531) A dc supply of 120V is connected to a large resistance X. A voltmeter of resistance 10kΩ placed in series in the circuit reads 4V. What is the value of X? What so you think is the purpose in using a voltmeter instead of an ammeter to determine the large resistance X?

532) A 24V battery o internal resistance 1.5Ω is connected to three coils 18Ω , 9Ω and 6Ω in parallel, a resistor of 3.5 Ω and a reserved battery(e.m. = 12V and internal resistance = 3Ω) as shown. Calculate
(i) the current in the circuit
(ii) current in resistor of 18Ω coil and
(iii) p.d. across each battery.



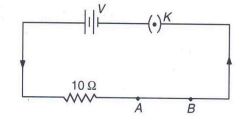
533) The potential difference across a potentiometer wire 8m long 2.5V. Calculate the e.m.f of the cell which is balanced by 100 cm long wire.

534) Current flowing through a wire varies with time t in second as I = (2t + 4) A. How much charge passes through a cross section of the wire in 2 sec?

535) You are given a 8 Ω resistor. What length of constant wire of resistance 120Ω m^{-1} should be joined in parallel with it to get a value of 6Ω ?

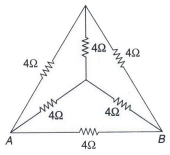
536) The e.m.f of a cell measured using a potentiometer is found to be 1.5V. An accurate voltmeter connected across the terminals of the cells reads 1.4V. Explain the discrepancy and calculate the ratio of the resistance of the cell.

537) In the circuit shown here AB is a 2m long wire having a resistance of 5Ω . What battery voltage V will cause a potential gradient of 2V/m along the wire AB?



538) Two cells of e.m.f E_1 and E_2 ($E_1 > E_2$) are connected as shown below.
When a potentiometer is connected between A and B the balancing length of the potentiometer is 300cm. On connecting the same potentiometer between A and C, the balancing length is 100cm. Calculate the ratio of E_1 and E_2.

539) Calculate (i)the equivalent resistance between A and B of the electrical network given below and (ii)the current drawn by the network in a battery of e.m.f 8V internal resistance 1Ω is connected across the points A and B.



540) The length of the potentiometer wire is 600cm and it carries a current of 40mA. For a cell of e.m.f. 2V and internal resistance 10Ω the null point is found to be at 500 cm. If a voltmeter is connected across the cell the balancing length is decreased by 10 cm. Find
(i) the resistance of whole wire
(ii) reading of voltmeter and
(iii) resistance of voltmeter.

541) With a certain unknown resistance X in the left gap and a resistance of 8Ω in the right gap, null point is obtained on the meter-bridge wire. On putting another 8Ω resistor in parallel with the 8Ω resistor in the right gap, the null point is found to shit by 15cm. Find the value of X from these observations.

542) A storage battery of a car has an e.m.f. of 12V. If the internal resistance of the battery is 0.4Ω , what is the maximum current that can be drawn from the battery?

543) A battery of e.m.f. 10V and 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 of the battery when the circuit is closed?

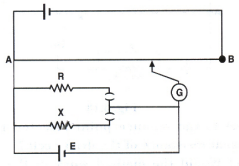
544) (a) Three resistors $1\Omega, 2\Omega \; and \; 3\Omega$ are combined in series. What is the total resistance of the combination?
(b) If the combination is connected to a battery of emf 12 V and negligible internal resistance, obtain the potential drop across each resistor.

545) (a) Six lead-acid type of secondary cells each of emf 2.0 V and internal resistance are joined in series to provide a supply to a resistance of 8.5Ω . What are the currents drawn from the supply, and its terminal voltage? (b) A secondary cell after long use has an emf 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?

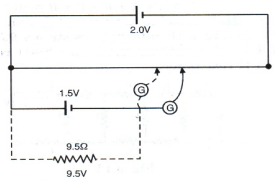
546) Answer the following questions:
(a) A steady current flows in a metallic conductor of non-uniform cross-section. Say which of these quantities is constant along the conductor current density, electric field, drift speed?
(b) Is Ohm's law universally applicable for all conducting elements? If not, 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 6kV must have a very large internal resistance. Why?

547) 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 coefficients of resistance than pure metals.
(c) The resistivity of alloy manganin (is nearly independent of/increases rapidly) with increases 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 $(10^{22}/10^{23})$.

548) Figure shows a potentiometer circuit for comparison of two resistances.The balance point with a standard resistor 10.0Ω is found to be 58.3cm while that with the unknown resistance X is 68.5cm. Determine the value of X is 68.5cm. Dtetermine the value of X. What would you do if you failed to find a balance point with the given cell of emf E?

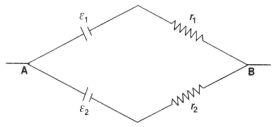


549) Figure shows a 2.0 V potentiometer used for the determination of internal resistance of 1.5V cell. The balance point of the cell in open circuit is 76.3 cm. When a resistor of 9.5Ω is used in external circuit of the cell, the balance point shifts to 64.8 cm length of the potentiometer wire. Determine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



550) Consider a current carrying wire in the shape of a circle. Note that as the current progresses along the wire, the direction of j changes in an exact manner, while the current I remain unaffected. The agent that is essentially responsible for is
(a) source of e.m.f.
(b) electric field produced by charges accumulated on the surface of wire.
(c) the charges just behind a given segment of wire which push them just the right way by repulsion.
(d) the charges ahead.

551) Two batteries of e.m.fs. $\varepsilon_1 \; and \; \varepsilon_2$ and internal resistances $r_1 and r_2$ respectively are connected in parallel as shown in fig.
(a) The equivalent e.m.f ε_{eq} of the two cells is between $\varepsilon_1 \; and \; \varepsilon_2$, i.e. $\varepsilon_1 < \varepsilon_{eq} < \varepsilon_2$.
(b) The equivalent e.m.f. ε_{eq} is smaller than ε_1
(c) The ε_{eq} is given by always $\varepsilon_{eq} = \varepsilon_1 + \varepsilon_2$
(d) ε_{eq} is independent of internal resistances $r_1 \; and \; r_2$



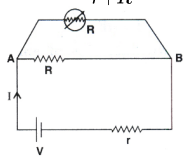
552) A resistance R is to be measured using a meter bridge. Student chooses the standard resistances S to be 100Ω . He finds the null point at $l_1 = 2.9cm$. He is told to attempt to improve the accuracy. Which of the following is a useful way?
(a) He should measure l_1 more accurately.
(b) He should change S to 1000Ω and repeat the experiment.
(c) He should change S to 3Ω and repeat the experiment.
(d) He should give up hope of a more accurate measurement with a meter bridge.

553) Two cells of emf's approximately 5V and 10V are to be accurately compared using a potentiometer of length 400cm.
(a) The battery that runs the potentiometer should have voltage of 8V.
(b) The battery of potentiometer can have a voltage of 15v and R adjusted so that the potential drop across the wire slightly exceeds 10v.
(c) The first portion of 50 cm of wire itself should have a potential drop of 10v.
(d) Potentiometer is usually used for comparing resistances and not voltages.

554) Which of the following characteristics of electrons determines the current in a conductor?
(a) Drift velocity alone
(b) Thermal velocity alone
(c) Both drift velocity and thermal velocity
(d) Neither drift nor thermal velocity.

555) Kirchhoff's junction rule is a reflection of
(a) conservation of current density vector.
(b) conservation of charge
(c) the fact that the momentum with which a charged particle approaches a junction is unchanged as the charged particle leaves the junction.
(d) the fact that there is no accumulation of charges at a junction.

556) Consider a simple circuit. Variable resistance R'.R' can vary from R_0 to infinity. r is internal resistance of the battery
(a) Potential drop across AB is nearly a constant as R' is varied.
(b) Current through R' is nearly a constant as R' is varied.
(c) Current I depends sensitively on R'.
(d) $I \geq \frac{V}{r+R}$ always.



557) Temperature dependence of resistivity $\rho(T)$ of semiconductors, insulators and metals is significantly based on the following factors:
(a) number of charge carriers can change with temperature T.
(b) time interval between two successive collisions can depend on T.
(c) length of material can be a function of T.
(d) mass of carriers is a function of T.

558) Is the motion of a charge across junction momentum conserving? Why or why not?

559) The relaxation time τ is nearly independent of applied E field whereas it changes significantly with temperature T. First fact is responsible for Ohm's law whereas the second fact lends to variation of ρ with temperature. Elaborate why?

560) What are the advantages of the null-point method in a wheatstone bridge? What additional measurements would be required to calculate $R_{unknown}$ by any other method?

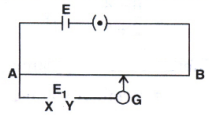
561) What is the advantages of using thick metallic strips to join wires in a potentiometer?

562) For wiring in the home, one uses Cu wires or Al wires. What considerations are involved in this?

563) Why are alloys used for making standard resistance coils?

564) Power P is to be delivered to a device via transmission cables having resistance R_c . If V is the voltage across R and I the current through it, find the power wasted and how can it be reduced.

565) While doing an experiment with potentiometer it was found that the deflection is one sided and
(i) the deflection decreased while moving from one end A of the wire to the end B;
(ii) the deflection increased, while to the end B; (ii) the deflection increased, while the jockey was moved towards the end B.



(i) Which terminal +ve or -ve of the cell E_1 , is connected at X in case (i) and how is E_1 related to E?
(ii) Which terminal of the cell E_1 is connected at X in case(ii)?

566) A cell of emf E and internal resistance r is connected across an external resistance R. Plot a graph showing the variation of potential difference across R, V verses R.

567) How many electrons pass through a wire in 2 minutes, if the current passing through wire is 300 mA?

568) If 22.5×10^{20} electrons pass through a wire in one minute, find the magnitude of the current flowing through the wire.

569) 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

570) A given wire having resistance R is stretched so as to reduce its diameter of half of its previous value. What will be its new resistance?

571) First resistors of 12Ω each are connected in parallel. Three such combination are then connected in series. What is the total resistance? What is the total resistance ? If a battery of 9 volt e.m.f. and negligible internal resistance is connected across the network of resistors, find the current flowing through each resistor.

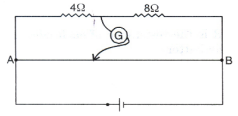
572) Three identical cells each of emf 2V and unknown internal resistance are connected in parallel. This combination is connected to a 5-ohm resistor. If the terminal voltage across the cells is 1.5V, what is the internal resistance of each cell?

573) A battery of e.m.f. 'E' and internal resistance 'r', gives a current of 0.5 A with an external resistor of 12 ohms and current of 0.25 ohm. Calculate
(i) internal resistance of the cell and
(ii) e.m.f. of the cell.

574) A wire of uniform cross-section and length l has a resistance of 16 ohms. It is cut into four equal parts. Each part is stretched uniformly to length l and all the four stretched parts are connected in parallel. Calculate the total resistance of the combination so formed. Assume that stretching of wire does not cause any change in the density of its material.

575) A wire has a resistance of 32 ohm. It is melted and drawn into a wire of half its original length. Calculate the resistance of new wire. What is percentage change in resistance?

576) The potentiometer wire AB shown in figure is 600cm long. Where should the free end of the galvanometer be connected on AB so that the galvanometer shows zero deflection?



577) A set of n identical resistors each of resistance R, when connected in series, have an effective resistance X ohm and when connected in parallel, their effective resistance is Y ohm.Find the relation between R,X and Y.

578) A battery of e.m.f 3 volt and internal resistance r is connected in series with a resistor of 55ohm through an ammeter of resistance i ohm. The ammeter reads 50 mA. Draw the circuit diagram and calculate the value of r.

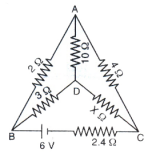
579) A wire of resistance 5 ohm is drawn out so that its length is increased by twice its original length. Calculate its new resistance.

580) Calculate the conductance and conductivity of resistance 0.01Ω , area of cross-section 2cm square and length 10cm.

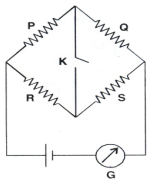
581) With a certain cell, the balance point is obtained at 60cm. from the end of the potentiometer wire. With another cell whose e.m.f. differs from the first cell by 0.1 volt, the balance point is obtained at 55cm mark. Calculate e.m.f. of the cells.

582) A letter 'A' consists of a uniform wire of resistance 1 ohm per cm. The sides of the letter are each 20 cm long and the cross piece in the middle is 10 cm long while the apex angle is 60° . Find the resistance of the letter between the two ends of the legs.

583) Find the value of unknown resistance X in the following circuit, if no current flows through the section AD. Also calculate the current drawn by the circuit from the battery of cmf 6V and negligible internal resistance.



584) In a Wheatstone bridge experiment, a student by mistake connects key (K) in place of galvanometer and galvanometer (G) in place of the key (K). How will be the test for the balance of the bridge?



585) If 2 x 10^{20} electrons pass through a lamp in one minute, what is the current in milliamperes?

586) In Bohr model of hydrogen atom, the electron revolves around the nucleus in a circular orbit of radius 5.1 x 10^{-11} m at a frequency of 6.8 x 10^{15} revolutions per second. Find the equivalent current at any point on the orbit of the electron.

587) A solution of sodium chloride discharges 6.0 x 10^{16} Na^+ ions and 4.5 x 10^{16} Cl^{-1} ions in 2 seconds. What is the current passing through the solutions?

588) In hydrogen atom, the electron moves in an orbit of radius 5.0 x 10^{-11} m with a speed of 2.2 x 10^6 ms^{-1}. Find the equivalent current. Electronic charge = 1.6 x 10^{-19} C.

589) If 6.0 mole of electrons flow through a wire in 50 minutes. What is (a) the total charge that passes through the wire, and (b) the magnitude of the current? Avogadro's number = 6 x 10^{23} per mol.

590) The charge flowing through a conductor varies with time as $q = 8t - 3t^2 + 5t^3$ Find
(i) the initial current
(ii) time after which the current reaches a maximum value
(iii) the maximum or minimum value of current.

591) The charge flowing through a conductor varies with times as $q = 2t - 6t^2 + 10t^3$, where q is in coulomb and t in second. Find
(i) the initial current
(ii) the time after which the value of current reaches a maximum value
(iii) the maximum or minimum value of current.

592) An electric current of $20\ \mu A$ appears in a discharge tube. If the discharge current is due to flow of equal number of electrons and protons, then how many electrons and protons, then how many electrons flow across a cross-section of the tube in 2 minutes.

593) A conductor of length L is connected to a d.c. source of emf ϵ. The drift velocity of electron is v_d. If the length of conductor is tripled by stretched it, keeping ϵ constant, find its drift velocity.

594) A copper wire has a resistance of $10\ \Omega$ and an area of cross-section 1 nm^2. A potential difference of 10 V exists across the wire. Calculate the drift speed of the electrons if the number of electrons per cubic metre in copper is 8 x 10^{28} electrons.

595) The number of free electrons per 5 cm of ordinary copper wires is 2 x 10^{21}. The average drift speed of electrons is 0.25 mm/s. What is the current flowing?

596) Estimate the average drift speed of conduction electrons in a copper wire of cross-sectional area 2.5 x 10^{-7} m^2 carrying a current of 2.7 A. assume the density of conduction electrons to be 9 x 10^{28} m^{-3}.

597) A copper wire of diameter 2.0 mm carries a current of 2.4 A. Copper has 8.5 x 10^{28} atoms per cubic metre. Find the drift speed of electrons assuming that one free electron (of charge 1.6 x 10^{-19} C) is associated with each atom of copper.

598) What is the drift velocity of electrons in a silver wire of length 1 m, having cross -sectional area 3.14 x 10^{-6} m^2 and carrying a current of 10 A. Given atomic weight of silver = 108, density of silver 10.5 x 10^3 kg/m^3, charge of electron 1.6 x 10^{-19} C, Avogadro's number = 6.023 x 10^{26} per kg. atom.

599) Protons in cosmic rays strike the earth's upper atmosphere at a rate, average over the earth's surface of 10 protons $m^{-2}s^{-2}$. What does the total current the earth receive from beyond its atmosphere in the form of incident cosmic ray protons? The earth's radius is 6.4 x 10^6m.

600) A uniform copper wire of length 1 m and cross-sectional area 5 x 10^{-7} m^2 carries a current of 1 A. Assuming that there are 8 x 10^{28} free electrons per m^3 in copper, how long will an electron take to drift from one end of the wire to the other. Charge on an electron = 1.6 x 10^{-19} C.

601) The number density of electrons in copper is 8.5 x 10^{28} m^{-3}. Find the current flowing through a copper wire of length 0.2 m, area of cross-section 1 mm^2, when connected to a battery of 4 V. Given that electron mobility = 4.5 x 10^{-6} $m^2V^{-1}s^{-1}$ and charge on electron is 1.6 x 10^{-19} C.

602) A current of 2 A is flowing through a wire of length 1 m and cross-sectional area 2 mm^2. If wire contains 8.5 x 10^{28} electrons/m^3, calculate the average time taken by electron to cross the length of the wire.

603) Assuming that there is one free electron per atom in copper. Density is 8.9 x 10^3 kg m^{-3} and atomic weight is 63.5. Avogadro's number is 6.02 x 10^{26} per kg-atom. If the current flowing through the copper wire is 1.5 A and its diameter is 1.2 mm, find the drift velocity of electron.

604) Calculate the resistivity of a material of a wire 10 m long, 0.4 mm in diameter and having a resistance of $2.0\ \Omega$.

605) An arc lamp operates at 80 V, 10 A. Suggest a method to use it with a 240 V d.c. source. Calculate the value of the electric component required for this purpose.

606) A wire 50 cm long and 0.12 mm diameter has a resistance of $4.0\ \Omega$. Find the resistance of another wire of the same material whose length is 1.5 m and diameter is 0.15 mm.

607) A uniform wire of length l and radius r has resistance $100\ \Omega$. It is recast into a thin wire of (i) length 2 l (ii) radius r/2. Calculate the resistance of new wire in each case.

608) There are two wires of copper and iron of the same length but different radii. When equal potential difference is applied between the ends of each wire, the same current flows in them. What the ratio of their radii. Specific resistances of copper and iron are 1.6 x 10^{-8} Ωm and 1.0 x 10^{-7} Ωm respectively.

609) A wire of mass 10 g, radius 1 mm is compressed to its length by 10%. Calculate the percentage change in its resistance.

610) A wire is stretched to increase its length by 5%. Calculate percentage change in its resistance.

611) A rheostat has 100 turns of a wire of radius 0.1 mm having resistivity 4.9 x 10^{-8} Ωm . The diameter of each turn is 5 cm. What is the maximum value of resistance that it can introduce?

612) Calculate the mass of copper required to draw a wire 5 km long having resistance of $15\ \Omega$. The density of copper is 8.9 x 10^3 kg m^{-3} and resistivity of copper is 1.7 x 10^{-8} Ωm .

613) Two wires A and B of the same material have their lengths in the ratio 5 : 3 and diameter in the ratio 2 : 3. If the resistance of wire A is 15 Ω , find the resistance of wire B.

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

615) Find the time of relaxation between collision and free path of electrons in copper at room temperature. (Given, resistivity of copper = 1.7 $\times$ 10^{-8} Ω -m, density of electrons in copper = 8.5 $\times$ 10^{28} m^{-3}, charge on an electron = 1.6 $\times$ 10^{-19} C, mass of electron = 9.1 $\times$ 10^{-31} kg and drift velocity of free electrons = 1.6 $\times$ 10^{-4} ms^{-1})

616) Calculate the conductance and conductivity of a wire of resistance 0.01 Ω , area of cross-section $10^{-4}m^2$ and length 0.1 m.

617) A rheostat has 1000 turns of a wire of radius 0.4 mm, having resistivity 49 x 10^{-8} Ωm . The diameter of each turn is 4 cm. What are the maximum values of conductance and conductivity of rheostat wire.

618) A copper wire of diameter 0.16 cm is connected in series to an aluminium wire of diameter 0.25 cm. A current of 10 ampere is passed through them. Find (a) current density in copper wire. (b) drift velocity of electron in the aluminium wire. The number of free electrons per unit volume of aluminium wire is 10^{29} m^{-3}.

619) A wire carries a current of 2.0 A, when a potential difference of 3.0 V is applied across it. What is its conductance? If the wire is of length 3 m and area of cross-section 5.4 x $10^{-6}m^2$, calculate its conductivity.

620) Calculate the radius of the wire of conductance $10\ \Omega^{-1}$ and length 10 cm whose electrical conductivity is 10^5 Sm^{-1}.

621) The resistance of a conductor is $6\ \Omega$ at 50°C and $7\ \Omega$ at 100°C. Calculate the mean temperature coefficient of resistance of the material. Find the resistance of the conductor at 0°C.

622) P, Q, R and S are four resistance wires of resistance 3, 3, 3 and 4 ohms respectively. They are connected to form the four arms of Wheatstone bridge circuit. Find out the resistance with which S must be shunted in order that bridge may be balanced.

623) In a meter bridge when the resistance in the left gap is $4\ \Omega$ and an unknown resistance in the right gap, the balance point is obtained at 40 cm from the zero end. On shunting the unknown resistance with $4\ \Omega$, find the shift of the balance point on the bridge wire.

624) Four resistances of $16\ \Omega$, $12\ \Omega$, $4\ \Omega$ and $9\ \Omega$ respectively are connected in cyclic order to form a Wheatstone bridge. Calculate the resistance to be connected in parallel with $9\ \Omega$ resistance to balance the bridge.

625) In comparing the resistance of two coils P and Q with a slide wire bridge, a balance point is obtained when the sliding contact is 30 cm from the zero end of the wire. The resistances P and Q are interchanged and the balance is obtained at 120 cm from the same end. Find the ratio of the resistances P and Q and the length of the bridge wire.

626) In a potentiometer arrangement, a cell of emf 1.20 V gives a balance point at 30 cm length of the wire. This cell is now replaced by another cell of unknown emf. If the ratio of emfs of the two cells is 1.5, calculate the difference in the balancing length of the potentiometer wire in the two cases.

627) The resistance of a potentiometer wire of length 10 m is $20\ \Omega$. A resistance box and a 2 V accumulator are connected in series with it. What resistance should be introduced in the box to have a potential drop of one microvolt per millimetre of the potentiometer wire?

628) With a certain cell the balance point is obtained at 70 cm from the zero end of the potentiometer wire. With another cell whose emf differs from the first cell by 0.2 V, the balance point is obtained at 60 cm mark. Calculate the emf of the two cells.

629) A 10 m long wire of uniform cross-section and $10\ \Omega$ resistance is used in a potentiometer. The wire is connected in series with a battery of 4 V along with an external resistance of $290\ \Omega$. If an unknown emf ϵ is balanced at 6.0 m length of the wire, calculate
(i) potential gradient of potentiometer wire
(ii) the value of unknown emf ϵ.

630) A standard cell of emf 1.08 V is balanced by the potential difference across 91 cm of a metre long wire supplied by a cell of emf 2 V through a series resistor of resistance $2\ \Omega$. The internal resistance of the cell is zero. Find the resistance per unit length of the potentiometer wire.

631) A potentiometer having a wire 10 m long stretched on it is connected to a battery having a steady voltage. A leclanche cell gives a null point at 750 cm. If the length of potentiometer wire is increased by 100 cm, find the new position of null point.

632) In an experiment with a potentiometer to measure the internal resistance of a cell, when the cell in the secondary circuit is shunted by $5\ \Omega$, the null point is at 220 cm. When the cell is shunted by $20\ \Omega$ the null point is at 300 cm. Find the internal resistance of the cell.

633) In an experiment of calibration of voltmeter, a standard cell of emf 1.1 V is balanced against 440 cm of potentiometer wire. The potential difference across the ends of a resistance is found to balance against 220 cm of the wire. The corresponding reading of voltmeter is 0.5 volt. Find the error in the reading of voltmeter.

634) A battery of emf ϵ volt and internal resistance r ohm is joined in series with two resistances X and Y ohm in a closed circuit. A standard cell of emf 1.06 V and a galvanometer are joined in series and the combination is connected across X. The galvanometer shows no deflection when X = $60\ \Omega$ and Y = $224\ \Omega$ or when X = $40\ \Omega$ and Y = $140\ \Omega$. Calculate the values of E and r.

635) The resistance of a tungsten filament at 160°C is $132\ \Omega$. What will be its resistance at 400°C? The temperature coefficient of resistance of tungsten is 4.5 x 10^{-3} °C^{-1}.

636) The temperature coefficient of a resistance wire is 0.00125°C^{-1}. At 300 K its resistance is $1\ \Omega$. At what temperature the resistance of wire will be $2\ \Omega$?

637) A metal wire of diameter 2 mm and length 50 cm has a resistance $0.31\ \Omega$ at 25°C and $0.51\ \Omega$ at 125°C. Find
(i) the temperature coefficient of resistance
(ii), resistance at 0°C and
(iii) resistivity at 0°C and 25°C.

638) A resistance coil marked $3\ \Omega$ is found to have a true resistance of $3.115\ \Omega$ at 300 K. Calculate the temperature at which marking is correct. Temperature coefficient of resistance of the material of coils is 4.2 x 10^{-3} °C^{-1}.

639) (a) At what temperature would the resistance of a copper conductor be double of its value at 0°C?
(b) Does this same temperature hold for all copper conductors, regardless of the size and shape? Temperature coefficient of copper is 4.0 x 10^{-3}/°C.

640) A carbon resistance of $4.7\ k\Omega$ is to be marked with strips or bands of different colours for its identification. Write the sequence of colours.

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

642) A current of 5 mA is passed through a colour coded carbon resistor with first, second and third rings of black, brown and red. What is the voltage drop across the resistor?

643) What is the colour of the third band of a coded resistor of resistance $0.34\ \Omega$?

644) A parallel combination of three resistors take a current of 7.5 A from a 30 V supply. If the two resistors are $10\ \Omega$ and $12\ \Omega$, find the third one.

645) A wire of resistance $2.20\ \Omega$ has a length 2 m. Calculate the length of the similar wire which connected in parallel with 2 m length wire, will give a resistance of $2.0\ \Omega$.

646) When a current of 0.5 A is passed through two resistances in series, the potential difference between the ends of the series arrangement is 12.5 V. On connecting them in parallel and passing the current of 1.5 A, the potential difference between their ends is 6 V, calculate the two resistances.

647) A uniform wire of resistance $4\ \Omega$ is bent into the from of a circle of radius r. A specimen of the same wire is connected along the diameter of the circle. What is the equivalent resistance across the ends of this wire?

648) You are given n resistors each of resistance r. These are first connected to get minimum resistance. In the second case, these are again connected differently to get maximum possible resistance. Compute the ratio between the minimum and maximum values of resistance so obtained.

649) It is found that when R = $4\ \Omega$, the current is 1 A and when R is increased to $9\ \Omega$, the current reduces to 0.05 A. Find the values of the emf E and internal resistance r.

650) A battery of emf ϵ, and internal resistance r, gives a current of 0.5 A with an external resistor of $12\ \Omega$ and a current of 0.25 A with an external resistor of $25\ \Omega$. Calculate (i) internal resistance of the cell and (ii) emf of the cell.

651) The potential difference across the terminals of a battery is 9.0 V, when a current of 3.5 A flows through it from its negative terminal to the positive terminal. When a current of 2 A flows through it in the opposite direction, the terminal potential difference is 12 V. Find the internal resistance and emf of the battery.

652) A voltmeter with resistance $500\ \Omega$ is used to measure the emf of a cell of internal resistance $4\ \Omega$. What will be the percentage error in the reading of the voltmeter.

653) n identical cells are joined in series with two cells A and B with reverse polarities. EMF of each cell is E and internal resistance r. What is the potential difference across the cell A or B?

654) A cell of emf 2 V and internal resistance $0.1\ \Omega$ supplies a current through a coil of resistance $11.9\ \Omega$. The current is being measured by an ammeter whose resistance is $6\ \Omega$. What reading does it give? What is the percentage difference from the actual current, when the meter is not used?

655) You are given several identical resistances each of value R = $10\ \Omega$ and each capable of carrying a maximum current of one ampere. It is required to make a suitable combination of these resistances so as to have a resistance of $5\ \Omega$ capable of carrying a current of 4 amperes. Find the minimum number of resistances of the type R that will be required for the job.

656) Calculate the relaxation time and mean free path at room temperature (i.e. 27°C), if the number of free electrons per unit volume is 8.5 x 10^{28}/m^3 and resistivity $\rho = 1.7 \times 10^{-8} \Omega - m$. Given that mass of electron = 9.1 x 10^{-31} kg, e = 1.6 x 10^{-19}C and k = 1.38 x 10^{-23} JK^{-1}.

657) Twelve cells each having the same e.m.f. are connected in series and are kept in a closed box. Some of the cells are connected in reverse order. The battery is connected in series with an ammeter, an external resistance R and two cells of the same type as in the battery. The current when they aid each other is 3 ampere and current is 2 ampere when the two oppose each other. How many cells are connected in reverse order?

658) Voltmeters V_1 and V_2 are connected in series across a D.C. line. V_1 reads 80 V and has a per volt resistance of $200\ \Omega$. V_2 has a total resistance of $32\ k\ \Omega$. What is the line voltage?

659) A motor operating on 120 V draws a current of 3 A. If the heat is developed in the motor at the rate of 12 cal/s, what is its efficiency?

660) A generator is supplying power to a factory by cables of resistance $20\ \Omega$. If the generator is generating 50 kW power at 5000 V, what is the power received by factory?

661) An electric motor operating on a 50 V d.c. supply draws a current of 12 A. If the efficiency of the winding of the motor.

662) Calculate the amount of heat produced per second when a bulb of 100 W, 220 V glows, assuming that only 20% of electric energy is converted into light. J = 4.2 J cal^{-1}.

663) An electric motor operates on a 50 V supply and draws a current of 15 A. If the motor yields a mechanical power of 150 W, estimate the power dissipated across its windings. Also find the efficiency of the motor?

664) Find the resistance of 240 V - 200 watt electric bulb when glowing. If this resistance is 10 times the resistance at 0° C and the temperature of the glowing filament is 2000°C, then find the temperature coefficient of resistance of the filament.

665) Three equal resistance connected in series across a source of e.m.f. consume 20 watt. If the same resistors are connected in parallel across the same source of e.m.f., what would be the power dissipated?

666) In a house having 220 V line, the following appliances are working
(i) a 60 W bulb
(ii) a 1000 W heater
(iii) a 40 W radio.
Calculate
(a) the current drawn by heater and
(b) the current passing through the fuse line.

667) A dry cell of emf 1.6 V and internal resistance of $0.10\ \Omega$ is connected to a resistor of resistance $R\ \Omega$. If the current drawn from the cell is 2 A, then
(i) What is the voltage drop across R?
(ii) What is the rate of energy dissipation in the resistor?

668) An electric bulb is marked to 100 W, 230 V. If the supply voltage drops to 115 V, what is the heat and light energy produced by the bulb in 20 minutes. Calculate the current flowing through it.

669) An electric bulb and electric heater are rated 100 W, 220 V and 500 W, 220 V respectively. Both are connected in series to a 220 V d.c. mains. Calculate the power consumed by (i) electric bulb and (ii) heater.

670) An electric kettle was marked 500 W, 220 V and was found to raise 1 kg of water at 20°C to the boiling point in 20 minutes. Calculate the heat efficiency of the kettle. Sp. heat of water = 4200 J kg^{-1} K^{-1}.

671) A room is lighted by 200 W, 124 V incandescent lamps fed by a generator whose output voltage is 130 V. The conducting wires from the generator to the user are made of aluminium wire of total length 150 m and cross-sectional area 15 mm^2. How many such lamps can be installed? What is the total power consumed by the user? sp. resistance of aluminium is 2.9 x 10^{-8} Ωm .

672) A house is fitted with 20 lamps of 60 watt each, 10 fans consuming 0.5 ampere each and an electric kettle of resistance $110\ \Omega$. If the energy is supplied at 220 V and costs 150 paise per kWh, calculate monthly bill for running these appliances for 6 hours a day (1 month = 30 days).

673) A house wiring, supplied with a 220 V supply line is protected by a 9 ampere fuse. Find the maximum number of 60 W bulbs in parallel that can be turned on.

674) Find the cost of electricity for running an electric motor of 1 hp for 5 hrs a day at the rate of Rs. 1.50 per unit of electricity for the month of November.

675) A cell sends a current through a resistance R_1 for time t, next the same cell sends current through another resistance R_2 for the same time t. If the same amount of heat is developed in both the resistances, then find the internal resistance of the cell.

676) Water boils in an electric kettle in 15 minutes after switching on. If the length of the heating wire is decreased to 2/3 of its initial value, then in how much time the same amount of water will boil with the same supply voltage.

677) Two bulbs of 500 watt and 200 watt are manufactured to operate on 220 volt line. Find the ratio of heat produced in 500 watt and 200 watt, in two cases, when firstly they are joined in parallel and secondly in series to the supply voltage of 220 V.

678) Two resistance R_1 and R_2 may be connected either in series or in parallel across a battery of zero internal resistance. It is required that the joule heating for the parallel combination be five times that for series combination. If R_1 is 100 Ω , find R_2.

679) An electric bulb rated for 500 watt and 100 volt is used in a circuit having a 250 V supply. Calculate the resistance R that may be put in series with bulb so that the bulb delivers 500 watt.

680) The same mass of copper is drawn into two wires 1 mm and 2 mm thick. These two wires are connected in series to the source of current. What is the ratio of the heat produced in the wires?

681) (i) A storage battery of emf 8 V, internal resistance $1\ \Omega$ is being charged by a 120 V d.c. source, using a $15\ \Omega$ resistor in series in the circuit. Calculate the current in the circuit.
(ii) terminal voltage across the battery during charging and
(iii) chemical energy stored in the battery in 5 minutes.

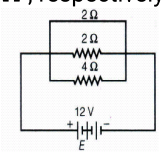
682) How many electrons pass through a lamp in 1 min, if the current is 300 mA. Given, the charge on an electron is $1.6 \times 10^{-19} C$

683) In a Wheatstone bridge circuit $\rho = 10\Omega$, $Q = 12\Omega$ and,$R = 8\Omega$ then find the value of S which is parallel to R.

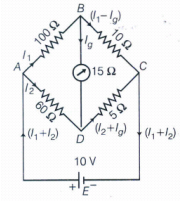
684) An aluminium wire of diameter 0.24cm is connected in series to a copper wire of diameter 0.16cm. The wires carry an electric current of 10A. Determine the current density in aluminium wire.

685) A potential difference of 3 V is applied across a conductor through which 5 A of current is flowing. Determine the resistance of the conductor.

686) The given network (shown in figure below) is representing the three resistors with resistances 2Ω , 2Ω and 4 Ω , respectively are connected in parallel with a 12 V battery. Determine the equivalent resistance of the network.



687) The Wheatstone bridge circuit have the resistances in various arms as shown in figure. Calculate the current through the galvanometer.



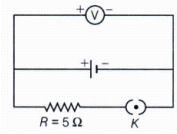
688) A resistor of 5Ω is connected in series with a parallel combination of a number of resistors each of 5Ω . if the total resistance of the combination is 6Ω , how many resistors are in parallel?

689) In a Wheatstone bridge circuit, P = 7Ω ,Q = 8 Ω , R = 12Ω and S = 7Ω . Find the additional resistance to be used in series with S, so that the bridge is balanced.

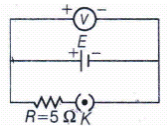
690) A resistance coil is made by joining in parallel two resistance each of 10 Ω . An emf of 1 V is applied between the two ends of coil for 5 minutes. Calculate the heat produced in calories.

691) When two resistance wires are in the two gaps of a meter bridge, the balance point was found to be 1/3 m from the zero end. When a 6Ω coil is connected in series with the smaller of the two resistances, the balance point is shifted to 2/3 m from the same end. Find the resistance of the two wires.

692) 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 connected to a resistance of 5 Ω as shown in figure given alongside, the voltmeter reading drops to 1.8 V. Find the internal resistance of the cell.



693) 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.



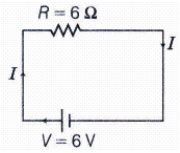
694) In a potentiometer arrangement, a cell of emf 2.25 V gives a balance point at 30 cm length of the wire.If the cell is replaced by another cell and the balance point shifts to 60 cm, what is the emf of the second cell?

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

696) A cell can be balanced against 110 cm and 100 cm of potentiometer wire, respectively when in open circuit and when short-circuited through a resistance of 10Ω . Find the internal resistance of the cell

697) Find the current flow through a copper wire of length 0.2m, area of cross-section 1mm^2, when connected to a battery of 4V. Given that electron mobility is $4.5 \times 10^{-6} m^2 s^{-1} V^{-1}$ and charge on an electron is 1.6×10^{-19} C. The number density of electron in copper wire is 8.5×10^{28} m^{-3}

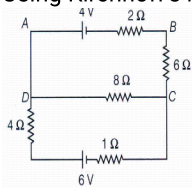
698) (i) Consider circuit in the figure. How much energy is absorbed by electrons from the initial state of no current (Ignore thermal motion) to the state of drift velocity?
(ii) Electrons give up energy at the rate of RI^2 per second to the thermal energy. What time scale would number associate with energy in problem (i)? Given, n = number of electron per volume = 10^{29} per m^3. Length of circuit = 10cm cross-section = A = (1 mm)^2



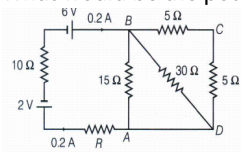
699) A circuit using a potentiometer and battery of negligible internal resistance is set up as shown to develop a constant potential gradient along the wire AB. Two cells of emf's E_1 and E_2 are connected in series as shown in combinations (1) and (2).
The balance points are obtained, respectively at 400 cm and 240 cm from the point A. Find
(i) E_1/ E_2
(ii) balancing length for the cell E_1 only.

700) 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.

701) Using Kirchhoff's rule, calculate the potential difference across the 8Ω resistance in the given circuit.

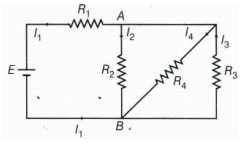


702) Calculate the value of the resistance R in the circuit shown in the figure, so that the current in the circuit is 0.2A. What would be the potential difference between points A and B?

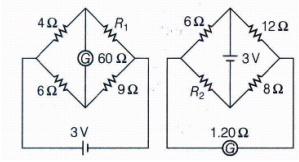


703) A potentiometer wire of length 1 m has a resistance of 10Ω . It is connected to 6 V battery in series with a resistance of 5Ω . Determine the emf of the primary cell, which gives a balance point at 40 cm.

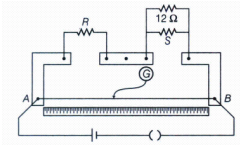
704) In the circuit shown, $R_1 = 4\ \Omega$, $R_2 = R_3 = 5\ \Omega$, $R_4 = 10\Omega$ and E = 6 V. Work out the equivalent resistane of the circuit and the current in each resistor.



705) 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.



706) In a meter bridge, the null point is found at a distance of 40 cm from A. If a resistance of 12Ω is connected in parallel with S, the null point occurs at 50 cm from A. Determine the values of R and S.



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

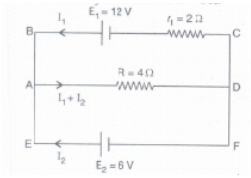
708) Define the term current density of a metallic conductor. Deduce the relation connecting current density (J) and the conductivity o of the conductor, when an electric field E, is applied to it.

709) Define the terms
(i) drift velocity,
(ii) relaxation time.
A conductor of length L is connected to a de source of emf E. If this conductor is replaced by another conductor of same material and same area of crosssection but of length 3 L, how will the drift velocity change?

710) 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 resistance of 5 Ω as shown in the circuit, the voltmeter reading drops to 1.8 V. Find the internal resistance of the cell.

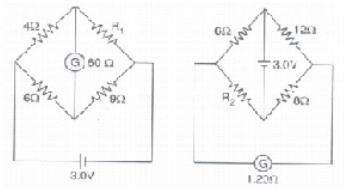
711) Two cells of emfs E_1 and E_2 having internal resistances r_1 and r_2 respectively are connected in parallel as shown. Deduce the expressions for the equivalent emf and equivalent internal resistance of a cell which can replace the combination between the points B_1 and B_2.

712) In the electric network shown in the figure, use Kirchhoff's rules to calculate the power consumed by the resistance R = 4 Ω.

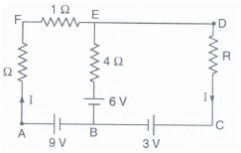


713) Answer following:
(a) Why are the connections between the resistors in a meter bridge made of thick copper strips?
(b) Why is it generally preferred to obtain the balance point in the middle of the meter bridge wire?
(c) Which material is used for the meter bridge wire and why?

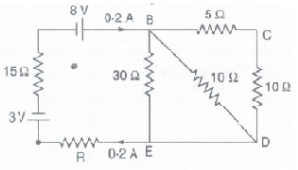
714) The galvanometer, in each of the two given circuits, does not show any deflection. Find the ratio of the resistors R_1 and R_2, used in these two circuits.



715) 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 A and D.



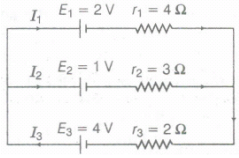
716) Calculate the value of the resistance R in the circuit shown in the figure so that the current in the circuit is 0.2 A. What would be the potential difference between points B and E?



717) What is Wheatstone bridge? Deduce the condition for which Wheatstone bridge is balanced.
The given figure shows a network of resistances R_1, R_2, R_3 and R_4 .
Using Kirchhoff's laws, establish the balance condition for the network.
Use Kirchhoff's law to obtain the balance condition for Wheatstone bridge.

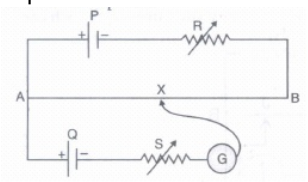
718) In the circuit shown, $R_1 = 4\Omega$, $R_2 = R_3 = 15\Omega$ $R_1 = 30\Omega$ and E = 10 V. Calculate the equivalent resistance of the circuit and the current in each resistor.

719) 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.



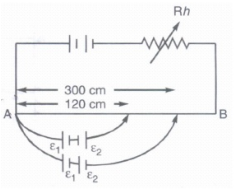
720) (a) State the underlying principle of a potentiometer. Why is it necessary to
(i) use a long wire,
(ii) have uniform area of cross-section of the wire and
(iii) use a driving cell whose emf is taken to be greater than the emf of the primary cells?
(b) In a potentiometer experiment, if the area of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

721) 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?

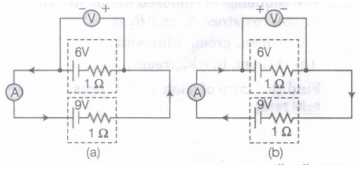
722) In the figure, a long uniform potentiometer wire AB is having a constant potential gradient along its length. The null points for the two primary cells of emf E_1 and E_2 connected in the manner shown are obtained at a distance of 120 cm and 300 cm from the end A. Find
(i) E_1/E_2 and
(ii) position of null point for the cell E_1 How is the sensitivity of a potentiometer increased?



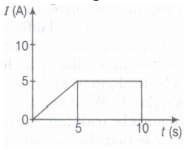
723) Write the principle of working of a potentiometer. Describe briefly, with the help of a circuit diagram, how a potentiometer is used to determine the internal resistance of a given cell.

724) Find the relation between drift Velocity and relaxation time of charge carriers in a conductor. A conductor of length 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.

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

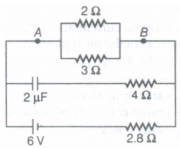


726) (i) Deduce the relation between current I flowing through a conductor and drift velocity v_d of the electrons.
(ii) Figure shows a plot of current I flowing through the cross-section of a wire versus the time t. Use the plot to find the charge flowing in t_2 see through the wire.



727) 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.

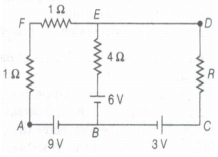
728) Calculate the steady current through the 2Ω resistor in the circuit shown in the figure.



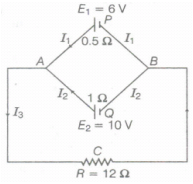
729) Three resistors R_1, R_2 and R_3 are connected in parallel, across a source of emf E and negligible internal resistance. Obtain a formula for the equivalent expressions for the current through each of the three resistors.

730) A straight line plot showing the terminal potential difference (V) of a cell as a function of current (1) drawn from it is shown in the figure. Using this plot, determine
(i) the emf and
(ii) internal resistance of the cell.

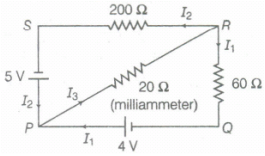
731) Using Kirchhoff's rules, determine the value of unknown resistance R in the circuit, so that no current flows through 4Ω resistance. Also, find the potential difference between points A and D.



732) State Kirchhoffs 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.

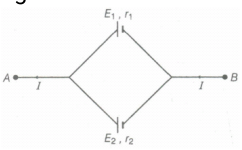


733) State Kirchhoff's rules. Apply these rules to the loops PRSP and PRQP to write the expressions for the currents I_1, I_2 and I_3 in given circuit.



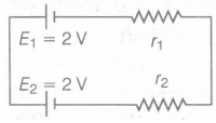
734) (i) State Kirchhoff's rules.
(ii) A battery of 10 V and negligible internal resistance is connected across the diagonally opposite corners of a cubical network consisting of 12 resistors each of 1Ω resistance. Use Kirchhoff s rules to determine
(a) the equivalent resistance of the network and
(b)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

735) 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.

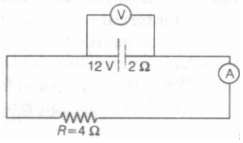


Deduce the expressions for
(i) the equivalent emf of the combination.
(ii) the equivalent resistance of the combination and
(iii) the potential difference between the points A and B.

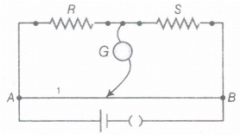
736) State Kirchhoff's rules. Use Kirchhoff's rules to show that no current flows in the given circuit.



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



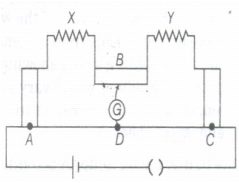
738) Write the principle of working of a metre bridge.
(ii) In a metre bridge, the balance point is found at a distance l_1 with resistance R and S as shown in the figure. An unknown resistance X is now connected in parallel to the resistance S and the balance point is found at a distance l_2. Obtain a formula for X in terms of l_1, l_2 and S.



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

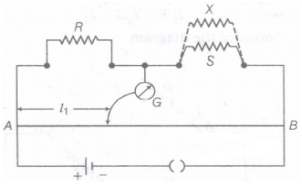
740) Two heating elements of resistances and R_1 when operated at a constant supply of voltage V, consume powers P_1 and P_2, respectively. Deduce the expressions for the power of their combination when they are in turn, connected in
(i) series and
(ii) parallel across their same voltage supply.

741)

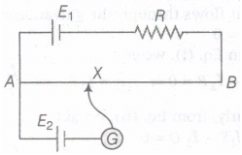


The figure shows experimental set up of a meter bridge. When the two unknown resistances X and Yare inserted, the null point D is obtained 40 cm from the end A.
When a resistance of 10 0 is connected in series with X, the null point shifts by 10cm.
Find the position of the null point when the 100 resistance is instead connected in series with resistance Y.
Determine the values of the resistances X and Y.

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



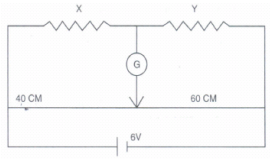
743) (i) In the circuit diagram given below AB is a uniform wire of resistance 15Ω and length 1m is connected to a cell E_1 of emf 2V and negligible internal resistance and a resistance R.
The balance point with another cell E_2 of emf 75 mV is found at 30 em from end A. Calculate the value of R.



(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.

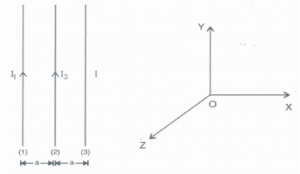
744) (i) State the working principle of a potentiometer. With the help of the circuit diagram, explain how a potentiometer is used to compare the emfs of two primary cells. Obtain the required expression used for comparing the emfs.
(ii) Write two possible causes for one sided deflection in a potentiometer experiment.
(iii) Why is potentiometer preferred over a voltmeter for comparison of emf of cells?
(iv) Draw a circuit diagram to determine internal resistance of a cell in the laboratory.

745) In the given circuit, a meter bridge is shown in the balanced state. The metre bridge wire has a resistance of. Calculate the unknown resistance X and the current drawn from the battery of a negligible internal resistance if the magnitude of Y is 6 Ω . If at the balancing point, we interchange the position of the galvanometer and the cell, how it will affect the position of the galvanometer?



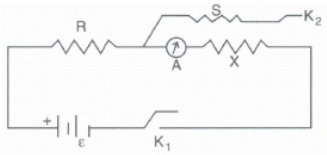
746) With the help of the circuit diagram, explain the working principle of meter bridge. How is it used to determine the unknown resistance of a given wire? Write the necessary precautions to minimize the error in the result

747) Three long straight parallel wires are kept as shown in the figure. The wire (3) carries a current I



(i) The direction of flow of current I in wire (3), is such that the net force, on wire (1), due to the other two wires,is zero.
(ii) By reversing the direction of I, the net force, on wire (2), due to the other two wires becomes zero. What will be the direction current I, in the two cases? Also obtain the relation between the magnitudes of currents $I_1, I_2 \; and \; I$

748) The reading of the (ideal) ammeter, in the circuit shown here, equals



(i) I when key K1is closed but key K2is open.
(ii) $\frac{1}{2}$ when both keys K1and K2are closed.Find the expression of the resistance of X in terms of the resistances of R and S.

749) The potential difference across a resistor 'r' carrying current 'I' is Ir
(i) Now if the potential difference across 'r' is measured using a voltmeter is less than true value.
(ii) Find the percentage error in measuring the potential difference by a voltmeter.
(iii) At what value of R_v , does the voltmeter measures the true potential true potential difference?

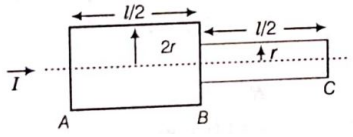
750) (i) Why do the 'free electrons', in a metal wire, 'flowing by themselves', not cause any current flow in the wire? Define 'drift velocity' and obtain an expression for the current flowing in a wire, in a terns of the 'drift velocity' of the free electrons.
(ii) Use the above expression to show that the 'resistivity', of the material of wire, is inversely proportional to the 'relaxation time' for the 'free electonics' in the metal.

751) How will you represent a resistance of 3700 Q ± 10% by colour code?

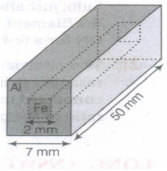
752) A wire carries a current of 0.5 A, when a potential difference of 1.5 Vis applied across it. What is its conductance? If the wire is of length 3m and area of cross-section 5.4 mm^2. then calculate its conductivity.

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

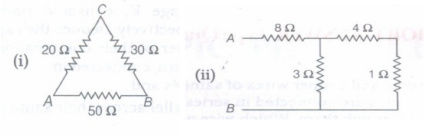
754) Two bars of radius r and 2r are kept in contact as shown in the figure. An electric current I is passed through the bars. Find the ratio of heat produced in bars AB and BC.



755) In an aluminium (A1)bar of square cross section, a square hole is drilled and is filled with iron (Fe) as shown in the figure. The electrical resistivities of A1 and Fe are 2.7 x 10^{-8} Ω-m and 1.0 x 10^{-7} Ω-m, respectively.
Calculate the electrical resistance between the two faces P and Q of the composite bar.



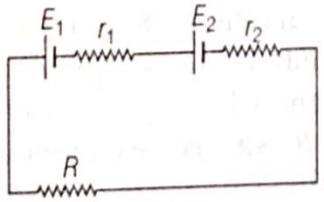
756) Find the equivalent resistance between A and B in the following cases



757) Two identical cells, when joined together in series or in parallel give the same current, when connected to external resistance of 2 Ω. Find the internal resistance of each cell.

758) 36 cells, each of internal resistance 0.5 Ω and emf 1.5 V each are used to send current through an external circuit of 2 Ω resistance. Find the best mode of grouping them and the current through the external circuit.

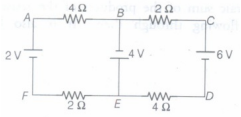
759) In the circuit shown in figure, E_1 = 10V, E_2 = 4V, r_1 = r_2 = 1Ω and R = 2Ω.
Find the potential difference across battery 1 and battery 2.



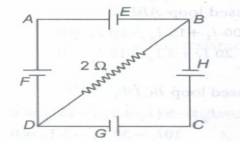
760) Which type of combination of cells is used in the following three cases.
(i) If the external resistance is much larger than the total internal resistance?
(ii) If the external resistance is much smaller than the total internal resistance?
(iii) If the external resistance is equal to the total internal resistance?

761) What do you mean by terminal potential difference of a cell? Under what conditions will the terminal potential difference of a cell be greater than its emf?

762) Find currents in different branches of the electric circuit shown in figure.

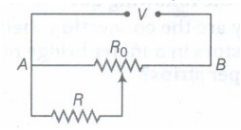


763) In the circuit shown in figure E, F, G, H are cells of emf 2, 1, 3 and 1 V respectively, and their internal resistances are 2, 1, 3 and 1 Ω, respectively. Calculate

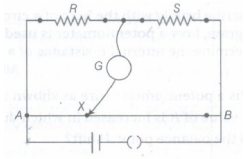


(i) the potential difference between B and D and
(ii) the potential difference across the terminals of each cells G and H.

764) A resistance of R draws current from a potentiometer. The potentiometer wire AB, has a total resistance of R_0. A voltage Vis supplied to the potentiometer. Derive an expression for the voltage across R, when the sliding contact is in the middle of potentiometer wire.



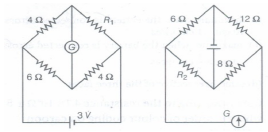
765) State the underlying principle of a potentiometer. Write two factors on which the sensitivity of a potentiometer depends. In the potentiometer circuit shown in the figure, the balance point is at X. State, giving reason, how the balance point is shifted when



(i) resistance R is increased?
(ii) resistance S is increased, keeping R constant?

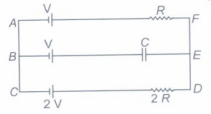
766) (i) State the working principle of a potentiometer. With the help of a circuit diagram, explain how a potentiometer is used to compare the emf of two primary cells. Obtain the required expression used for comparing the emfs.
(ii) Write two possible causes for one sided deflection in a potentiometer experiment.

767) Define the term current sensitivity of a galvanometer. In the circuits shown in the figures, the galvanometer shows no deflection in each case. Find the ratio of R_1 and R_2.



768) A number of identical cells, n, each of emf E, and internal resistance r connected in series are charged by a dc source of emf E', using a resistor R.
(i) Draw the circuit arrangement.
(ii) Deduce the expressions for
(a) the charging current, and
(b) the potential difference across the combination of the cells.

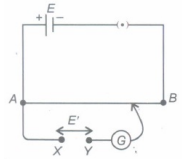
769) In the given circuit in the steady state, obtain the expressions for
(a) the potential drop
(b) the charge and
(c) the energy stored in the capacitor, C.



770) A potential difference Vis applied across a conductor of length L and diameter D. How are the electric field E and the resistance R of the conductor affected when
(i) V is halved
(ii) L is halved
(iii) D is doubled. Justify your answer.

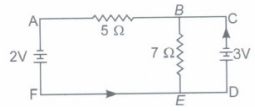
771) State the underlying principle of a potentiometer. Describe briefly, giving the necessary circuit diagram, how a potentiometer is used to measure the internal resistance of a given cell.

772) For the potentiometer circuit shown in the given figure, points X and Y represent the two terminals of an unknown emf E'. A student observed that when the jockey is moved from the end A to the end B of the potentiometer wire, the deflection in the galvanometer remains in the same direction.



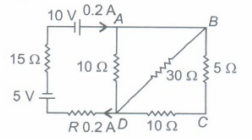
What may be the two possible faults in the circuit that could result in this observation?
If the galvanometer deflection at the end B is (i) more, (ii) less, than that at the end A, which of the two faults, listed above, would be there in the circuit?
Give reasons in support of your answer in each case.

773) Two resistances 5Ω and 7Ω are joined as shown to two batteries of emf 2 V and 3 V. If the 3 V battery is short circuited. What will be the current through 5Ω?

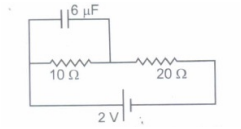


774) The current flowing through a conductor is 2mA at SOV and 3mA at 60V. Is it an ohmic or non-ohmic conductor? Give reason.

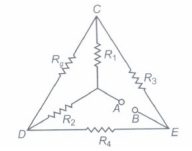
775) Calculate the value of the resistance R in the circuit shown in the figure so that the current in the circuit is 0.2 A. What would be the potential difference between points A and D?



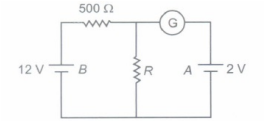
776) Find the charge on the capacitor as shown in the circuit.



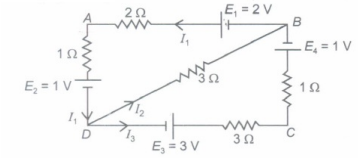
777) (i) Calculate the equivalent resistance of the given electrical network between points A and B.
(ii) Also calculate the current through CD and ACB, if a 10 V dc source is connected between A and B, and the value of R is assumed as 2 Ω.



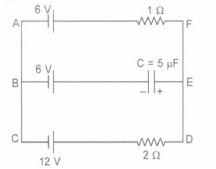
778) In the circuit shown in the figure, the galvanometer G gives zero deflection. If the batteries A and B have negligible internal resistance, find the value of the resistor R.



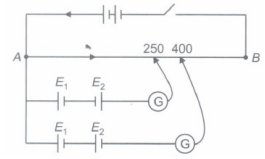
779) In the given network, find the values of the currents, I_1, I_2 and I_3.



780) In the given circuit, with steady current, calculate the potential difference across the capacitor and the charge stored in it.

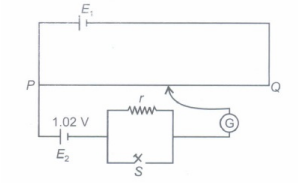


781) Two primary cells of emfs E_1 and E_2 ($E_1 > E_2$) are connected to the potentiometer wire AB as shown in the figure.

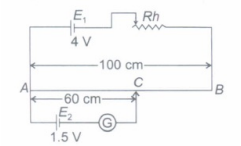


If the balancing lengths for the two combinations of the cells are 250 cm and 400 cm, find the ratio of E_1 and E_2.

782) Potentiometer wire, PQ of 1 m length is connected to a standard cell E_1 Another cell, E_2 of emf 1.02 V is connected as shown in the circuit diagram with a resistance r and a switch, S. When switch, S open, null position is obtained at a distance of 51 cm from P.
Calculate
(i) potential gradient of the potentiometer wire, and
(ii) emf of the cell E_1
(iii) When switch S is closed, will null point move towards P or towards Q?
Give reason for your answer.

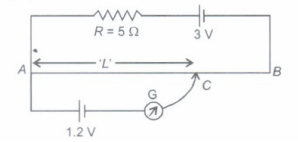


783) What is meant by the sensitivity of a potentiometer? A battery E_1 of 4 V and a variable resistance Rh are connected in series with the wire AB of the potentiometer. The length of the wire of the potentiometer is 1 m. When a cell E_2 of emf 1.5 V is connected between points A and C, no current flows through E_2 Length of AC = 60cm,



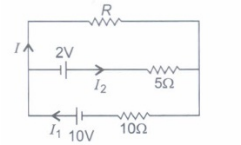
(i) Find the potential difference between the ends A and B of the potentiometer.
(ii) Would the method work, if the battery E_1 is replaced by a cell of emf of 1V?

784) The potentiometer wire of length 100 cm has a resistance of 10 Ω. It is connected in series with a resistance 5Ω and an accumulator of emf 3 V having negligible resistance.

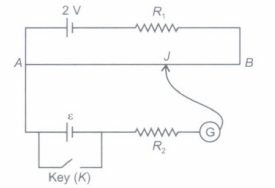


A source of 1.2 V is balanced against a length L of the potentiometer wire. Find the value of L.

785) Two cells of E.M.F. 10 V and 2 V and internal resistances 10 Ω and 5 Ω respectively, are connected in parallel as shown. Find the effective voltage across R.



786) Figure shows the circuit diagram of a potentiometer for determining the emf ε of a cell of negligible internal resistance.

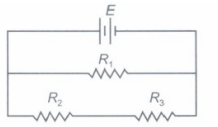


(i) What is the purpose of u s in g high resistance R_2?
(ii) How does the position of balance point (J) change when the resistance R_1 is decreased?
(iii) Why cannot the balance point be obtained
(1) When the emf E is greater than 2 Y, and
(2) When the key (K) is closed?

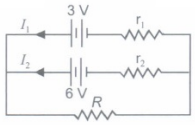
787) Three lamps each of resistance R are connected as shown. If lamp 2 fuses, then how will the brightness of lamp 1 gets affected?

788) Determine the electric current that will flow when a cell of emf E_1 (of negligible resistance) is connected in parallel to a battery of emf E_2 with internal resistance r.

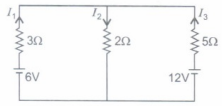
789) Three identical resistors R_1, R_2 and R_3 are connected to a battery as shown in figure. What will be the ratio of voltages across R1 and R_3?



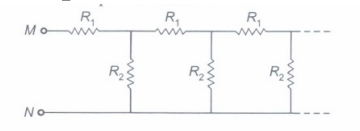
790) Under what condition(s) will the current I_1 and I_2 be in the directions as shown in the diagram here?



791) In the network given below, use Kirchhoff's laws to calculate the values of electric currents I_1, I_2 and I_3.



792) The figure shows an infinite circuit which is formed by the repetition of same chain consisting R_1 and R_2. If $R_1 = 4\ \Omega$ and $R_2 = 3\ \Omega$, then calculate the resistance between the points M and N.

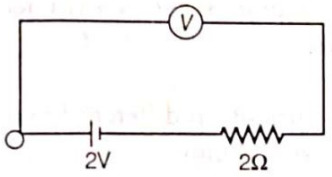


793) Calculate the drift velocity of electrons in a copper wire having cross-sectional area $3.14 \times 10^{-6}\ m^2$? and carrying a current of 16A.
Avogadro's number = 6.023×10^{23}
Atomic weight of copper = 64u,
Density of copper = $8.96 \times 10^3\ kgm^{-3}$,
$e = 1.6 \times 10^{-19} C$

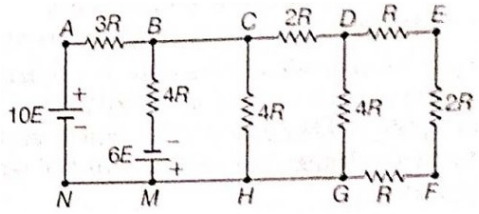
794) Two bulbs are marked 220V-100W and 220V-50W, respectively. They are connected in series to 220V mains. Determine the ratio of heat generated in them.

795) Under what condition will the current in a wire be the same when connected in series and in parallel of n identical cells having internal resistance r and external resistance R?

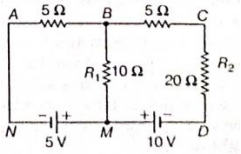
796) A voltmeter of resistance 998 Ω is connected across a cell of emf 2V and internal resistance 2Ω. Find the potential difference across the voltmeter and also across the terminals of the cell. Estimate the percentage error in the reading of the voltmeter.



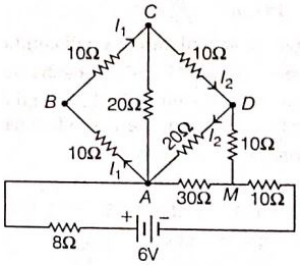
797) Find the current in branch BM in the network shown



798) Find the current flowing through the branches AB and BC in the network shown.



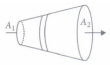
799) In the given network, calculate
(i) effective resistance between points A and M, and
(ii) power supplied by the battery.



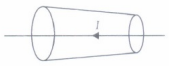
800) A wire of length L_o has a resistance R_o. It is gradually stretched till its length becomes $2L_o$
(i) Plot a graph showing variation of its resistance Rwith its length L during stretching.
(ii) What will be its resistance when its length becomes 2 L_o?

Case Study Questions 17 x 4 = 68

801) The flow of charge in a particular direction constitutes the electric current. Current is measured in Ampere. Quantitatively, electric current in a conductor across an area held perpendicular to the direction of flow of charge is defined as the amount of charge is flowing across that area per unit time.
Current density at a point in a conductor is the ratio of the current at that point in the conductor to the area of cross section of the conductor of that point.
The given figure shows a steady current flows in a metallic conductor of non uniform cross section. Current density depends inversely on area, so, here \(J_{1} > J_{2}, \text { as } A_{1}.



(i) What is the current flowing through a conductor, if one million electrons are crossing in one millisecond through a cross-section of it ?
(a) 2.5 x 10^{-10} A (b) 1.6 x 10^{-10} A
(c) 7.5 X 10^{-9} A (d) 8.2 x 10^{-11} A
(ii) SI unit of electric current is
(a) Cs (b) Ns^{-2} (c) Cs^{-1} $C^{-1}s^{-1}$
(iii) A steady current flows in a metallic conductor of non-uniform cross-section. Which of these quantities is constant along the conductor?
(a) Electric field (b) Drift velocity (c) Current (d) Current density
(iv) A constant current I is flowing along the length of a conductor of variable cross-section as shown in the figure. The quantity which does not depend upon the area of cross-section is



(a) electron density (b) current density
(c) drift velocity (d) electric field
(v) When a current of 40 A flows through a conductor of area 10 m^2, then the current density is
(a) 4 A/m^2 (b) 1 A/m^2 (c) 2 A/m^2 (d) 8 A/m^2

802) According to Ohm's law, the current flowing through a conductor is directly proportional to the potential difference across the ends of the conductor i.e $I \propto V \Rightarrow \frac{V}{I} = R$ where R is resistance of the conductor Electrical resistance of a conductor is the obstruction posed by the conductor to the flow of electric current through it. It depends upon length, area of cross-section, nature of material and temperature of the conductor We can write $R \propto \frac{l}{A}$ or $R = \rho \frac{l}{A}$ where ρ is electrical resistivity of the material of the conductor.

(i) Dimensions of electric resistance is

(a) $\left[\mathrm{ML}^2\ \mathrm{T}^{-2}\ \mathrm{A}^{-2}\right]$ (b) $\left[ML^2T^{-3}A^{-2}\right]$ (c) $\left[\mathrm{M}^{-1}\ \mathrm{L}^{-2}\ \mathrm{T}^{-1}\ \mathrm{A}\right]$ (d) $\left[M^{-1}L^2T^2A^{-1}\right]$

(ii) If $1\mu\mathrm{A}$ current flows through a conductor when potential difference of2 volt is applied across its ends, then the resistance of the conductor is

(a) $2 \times 10^6\Omega$ (b) $3 \times 10^5\Omega$ (c) $1.5 \times 10^5\Omega$ (d) $5 \times 10^7\Omega$

(iii) Specific resistance of a wire depends upon

(a) length **(b) cross-sectional area** **(c) mass** **(d) none of these**

(iv) The slope of the graph between potential difference and current through a conductor is

(a) a straight line **(b) curve**

(c) first curve then straight line **(d) first straight line then curve**

(v) The resistivity of the material of a wire 1.0 m long, 0.4 mm in diameter and having a resistance of 2.0 ohm is

(a) $1.57 \times 10^{-6}\Omega\mathrm{m}$ (b) $5.25 \times 10^{-7}\Omega\mathrm{m}$ (c) $7.12 \times 10^{-5}\Omega\mathrm{m}$ (d) $2.55 \times 10^{-7}\Omega\mathrm{m}$

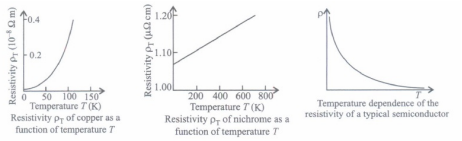
803) The resistance of a conductor at temperature t°C is given by $R_t = R_o (1 + \alpha t)$
where R_t is the resistance at t°C, R_o is the resistance at 0°C and α is the characteristics constants of the material of the conductor.

Over a limited range of temperatures, that is not too large. The resistivity of a metallic conductor is approximately given by $\rho_t = \rho_0(1 + \alpha t)$.

where α is the temperature coefficient of resistivity. Its unit is $\mathrm{K}^{-1}\mathrm{or}\ {}^\circ\mathrm{C}^{-1}$

For metals, α is positive i.e., resistance increases with rise in temperature.

For insulators and semiconductors, α is negative i.e., resistance decreases with rise in temperature.



(i) Fractional increase in resistivity per unit increase in temperature is defined as

(a) resistivity **(b) temperature coefficient of resistivity**

(c) conductivity **(d) drift velocity**

(ii) The material whose resistivity is insensitive to temperature is

(a) silicon **(b) copper** **(c) silver** **(d) nichrome**

(iii) The temperature coefficient of the resistance of a wire is 0.00125 per °C. At 300 K its resistance is 1 ohm. The resistance of wire will be 2 ohms at

(a) 1154 K **(b) 1100 K** **(c) 1400 K** **(d) 1127 K**

(iv) 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**

(v) For a metallic wire, the ratio V/I (V = applied potential difference and I = current flowing) is

(a) independent of temperature

(b) increases as the temperature rises

(c) decreases as the temperature rises

(d) increases or decreases as temperature rises depending upon the metal

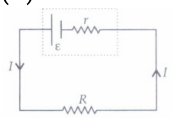
804) Emf of a cell is the maximum potential difference between two electrodes of the cell when no current is drawn from the cell. Internal resistance is the resistance offered by the electrolyte of a cell when the electric current flows through it. The internal resistance of a cell depends upon the following factors;

(i) distance between the electrodes

(ii) nature and temperature of the electrolyte

(iii) nature of electrodes

(iv) area of electrodes.



For a freshly prepared cell, the value of internal resistance is generally low and goes on increasing as the cell is put to more and more use. The potential difference between the two electrodes of a cell in a closed circuit is called terminal potential difference and its value is always less than the emf of the cell in a closed circuit. It can be written as V = E - Jr.

(i) The terminal potential difference of two electrodes of a cell is equal to emf of the cell when

$(a)\ I \neq 0$ **(b) I=0** **(c) both (a) and (b)** **(d) neither (a)nor (b)**

(ii) A cell of emf E and internal resistance r gives a current of 0.5 A with an external resistance of 12Ω and a current of 0.25 A with an external resistance of 25Ω .What is the value of internal resistance of the cell?

$(a)\ 5\Omega$ $(b)\ 1\Omega$ $(c)\ 7\Omega$ $(d)\ 3\Omega$

(iii) Choose the wrong statement.

(a) Potential difference across the terminals of a cell in a closed circuit is always less than its emf.

(b) Internal resistance of a cell decrease with the decrease in temperature of the electrolyte.

(c) Potential difference versus current graph for a cell is a straight line with a -ve slope

(d) Terminal potential difference of the cell when it is being charged is given as V = E + Ir.

(iv) An external resistance R is connected to a cell of internal resistance r, the maximum current flows in the external resistance, when

(a) R = r **(b) R < r** **(c) R > r** **(d) R=I/r**

(v) IF external resistance connected to a cell has been increased to 5 times, the potential difference across the terminals of the cell increases from 10 V to 30 V. Then, the emf of the cell is

(a) 30 V **(b) 60V** **(c) 50 V** **(d) 40 V**

805) Metals have a large number of free electrons nearly 10^{28} per cubic metre. In the absence of electric field, average terminal speed of the electrons in random motion at room temperature is of the order of 10^5 m s^{-1} When a potential difference V is applied across the two ends of a given conductor, the free electrons in the conductor experiences a force and are accelerated towards the positive end of the conductor. On their way, they suffer frequent collisions with the ions/atoms of the conductor and lose their gained kinetic energy. After each collision, the free electrons are again accelerated due to electric field, towards the positive end of the conductor and lose their gained kinetic energy in the next collision with the ions/atoms of the conductor. The average speed of the free electrons with which they drift towards the positive end of the conductor under the effect of applied electric field is called drift speed of the electrons.

(i) Magnitude of drift velocity per unit electric field is

(a) current density (b) current (c) resistivity (d) mobility

(ii) The drift speed of the electrons depends on

(a) dimensions of the conductor

(b) number density of free electrons in the conductor

(c) both (a) and (b)

(d) neither (a) nor (b)

(iii) We are able to obtain fairly large currents in a conductor because

(a) the electron drift speed is usually very large

(b) the number density of free electrons is very high and this can compensate for the low values of the 6 electron drift very small magnitude of the electron charge

(c) the number density of free electrons as well as the electron drift speeds are very large and these compensate for tl magnitude of the electron charge

(d) the very small magnitude of the electron charge has to be divided by the still smaller product of the number densit speed to get the electric current

(iv) Drift speed of electrons in a conductor is very small i.e., i = 10^{-4} m s^{-1}. The Electric bulb glows immediately. When the switch is closed because

(a) drift velocity of electron increases when switch is closed

(b) electrons are accelerated towards the negative end of the conductor

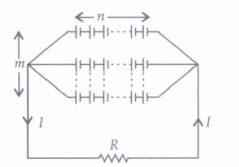
(c) the drifting of electrons takes place at the entire length of the conductor

(d) the electrons of conductor move towards the positive end and protons of conductor move towards negative end of the conductor

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

(a) 8.1 x 10^4 s (b) 2.7 x 10^4 s (c) 9 x 10^3 s (d) 3 x 10^3 S

806) A single cell provides a feeble current. In order to get a higher current in a circuit, we often use a combination of cells A combination of cells is called a battery, Cells can be joined in series, parallel or in a mixed way.
Two cells are said to be connected in series when negative terminal of one cell is connected to positive terminal of the other cell and so on. Two cells are said to be connected in parallel if positive terminal of each cell is connected to one point and negative terminal of each cell connected to the other point. In mixed grouping of cells, a certains number of identical cells are joined in series, and all such rows are then connected in parallel with each other.



(i) To draw the maximum current from a combination of cells, how should the cells be grouped?

(a) Parallel **(b) Series** **(c) Mixed grouping** **(d) Depends upon the relative values of internal and external resistances**

(ii) The total emf of the cells when n identical cells each of emf e are connected in parallel is

$(a)\ n\varepsilon$ $(b)\ n^2\varepsilon$ **(c) E** $d)\ \frac{\varepsilon}{n}$

(iii) 4 cells each of emf 2 V and internal resistance of 1Ω are connected in parallel to a load resistor of 2Ω . Then the current through the load resistor is

(a) 2 A **(b) 1.5 A** **(c) 1 A** **(d) 0.888 A**

(iv) If two cells out of n number of cells each of internal resistance 'r' are wrongly connected in series, then total resistance of the cell is

(a) 2nr **(b) nr - 4r** **(c) nr** **(d) r**

(v) Two identical non-ideal batteries are connected in parallel. Consider the following statements.

(i). The equivalent emf is smaller than either of the two emfs.

(ii) The equivalent internal resistance is smaller than either of the two internal resistances

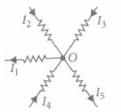
(a) Both (i) and (ii) are correct.

(b) (i) is correct but (ii) is wrong

(c) (ii) is correct but (i) is wrong.

(d) Both (i) and (ii) are wrong.

807) In 1942, a German physicist Kirchhoff extended Ohm's law to complicated circuits and gave two laws, which enable us to determine current in any part of such a circuit. According to Kirchhoff's first rule, the algebraic sum of the currents meeting at a junction in a closed electric circuit is zero. The current flowing in a conductor towards the junction is taken as positive and the current flowing away from the junction is taken as negative. According to Kirchhoff's second rule, in a closed loop, the algebraic sum of the emf's and algebraic sum of the products of current and resistance in the various arms of the loop is zero. While traversing a loop, if negative pole of the cell is encountered first, then its emf is negative, otherwise positive.

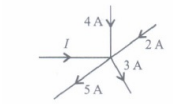


(i) Kirchhoff's Ist law follows

(a) law of conservation of energy **(b) law of conservation of charge**

(c) law of conservation of momentum **(d) Newton's third law of motion**

(ii) The value of current I in the given circuit is



(a) 4.5 A **(b) 3.7 A** **(c) 2.0 A** **(d) 2.5 A**

(iii) Kirchhoff's IInd law is based on

(a) law of conservation of momentum of electron **(b) law of conservation of charge and energy**

(c) law of conservation of energy **(d) none of these.**

(iv) Point out the right statements about the validity of Kirchhoff's Junction rule.

(a) The current flowing towards the junction are taken as positive.

(b) The currents flowing away from the junction are taken as negative.

(c) bending or reorienting the wire does not change the validity of Kirchhoff's Junction rule

(d) All ofthe above

(v) Potential difference between A and B in the circuit shown here is

(a) 4 V **(b) 5.6 V** **(c) 2.8 V** **(d) 6 V**

808) Wheatstone bridge is an arrangement of four resistances P, Q, Rand S connected as shown in the figure. Their values are so adjusted that the galvanometer G shows no deflection. The bridge is then said to be balanced when this condition is achieved happens. In the setup shown here, the points Band D are at the same potential and it can be shown that $\frac{P}{Q} = \frac{R}{S}$

This is called the balancing condition. If any three resistances are known, the fourth can be found.

The practical form of Wheatstone bridge is slide wire bridge or Meter bridge. Using this the unknown resistance can be determined as $S = \left(\frac{100-l}{l}\right) \times R$,where l is the balancing length of the Meter bridge.

(i) In a Wheatstone bridge circuit, $P = 5\Omega, Q = 6\Omega, R = 10\Omega$ and $S = 5\Omega$ What is the value of additional resistance to be used in series with S, so that the bridge is balanced?

$(\mathrm{a})\ 9\Omega \quad (\mathrm{b})\ 7\Omega \quad (\mathrm{c})\ 10\Omega \quad (\mathrm{d})\ 5\Omega$

(ii) A Wheatstone bridge consisting of four arms of resistances P, Q, R, S is most sensitive when

(a) all the resistances are equal

(b) all the resistances are unequal

(c) the resistances P and Q are equal but R > > P and S > > Q

(d) the resistances P and Q are equal but R < < P and S < < Q

(iii) When a metal conductor connected to left gap of a meter bridge is heated, the balancing point

(a) shifts towards right **(b) shifts towards left** **(c) remains unchanged** **(d) remains at zero**

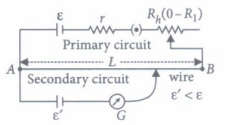
(iv) The percentage error in measuring resistance with a meter bridge can be minimized by adjusting the balancing point close to

(a) 0 **(b)·20cm** **(c) 50cm** **(d) 80cm**

(v) In a meter bridge experiment, the ratio ofleft gap resistance to right gap resistance is 2 : 3. The balance point from left is

(a) 20 cm **(b) 50 cm** **(c) 40 cm** **(d) 60 cm**

809) Potentiometer is an apparatus used for measuring the emf of a cell or potential difference between two points in an electrical circuit accurately. It is also used to determine the internal resistance of a primary cell. The potentiometer is based on the principle that, if V is the potential difference across any portion of the wire of length 1 and resistance R, then $V \propto l \text{ or } V = kl$ where k is the potential gradient. Thus, potential difference across any portion of potentiometer wire is directly proportional to length of the wire of that portion. The potentiometer wire must be uniform. The resistance of potentiometer wire should be high.



(i) Which one of the following is true about potentiometer?

(a) Its sensitivity is low

(b) It measures the emf of a cell very accurately

(c) It is based on deflection method

(d) None of the above

(ii) A current of 1.0 mA is flowing through a potentiometer wire of length 4 cm and of resistance 4Ω .The potential gradient of the potentiometer wire is

$(a)\ 10^{-3}\mathrm{Vm}^{-1}$ $(b)\ 10^{-5}\mathrm{Vm}^{-2}$ $(c)\ 2\times10^{-3}\mathrm{Vm}^{-1}$ $(d)\ 4\times10^{-3}\mathrm{Vm}^{-1}$

(iii) Sensitivity of a potentiometer can be increased by

(a) decreasing potential gradient along the wire

(b) increasing potential gradient along the wire

(c) decreasing current through the wire

(d) increasing current through the wire

(iv) A potentiometer is an accurate and versatile device to make electrical measurements of EMF because the method involves

(a) potential gradients

(b) a condition of no current flow through the galvanometer

(c) a combination of cells, galvanometer and resistances

(d) cells

(v) In a potentiometer experiment, the balancing length is 8 m, when the two cells E_I and E_2 are joined in series. When the two cells are connected in opposition the balancing length is 4 m. The ratio of the e. m. f. of two cells (E_I/E_2) is

(a) 1: 2 **(b) 2: 1** **(c) 1: 3** **(d) 3: 1**

810) Whenever an electric current is passed through a conductor, it becomes hot after some time. The phenomenon of the production of heat in a resistor by the flow of an electric current through it is called heating effect of current or Joule heating. Thus, the electrical energy supplied by the source of emf is converted into heat. In purely resistive circuit, the energy expended by the source entirely appears as heat. But if the circuit has an active element like a motor, then a part of the energy supplied by the source goes to do useful work and the rest appears as heat. Joule's law of heating form the basis of various electrical appliances such as electric bulb, electric furnace, electric press etc.

(i) Which of the following is a correct statement?

(a) Heat produced in a conductor is independent of the current flowing

(b) Heat produced in a conductor varies inversely as the current flowing

(c) Heat produced in a conductor varies directly as the square of the current flowing

(d) Heat produced in a conductor varies inversely as the square of the current flowing

(ii) If the coil of a heater is cut to half, what would happen to heat produced?

(a) Doubled **(b) Halved** **(c) Remains same** **(d) Becomes four times**

(iii) A 25 Wand 100 Ware joined in series and connected to the mains. Which bulbs will glow brighter?

(a) 100W **(b) 25 W**

(c) both bulbs will glow brighter **(d) none will glow brighter**

(iv) A rigid container with thermally insulated wall contains a coil of resistance 100Ω carrying current 1A. Change in its internal' energy after 5 min will be

(a) 0 kJ **(b) 10 kJ** **(c) 20 kJ** **(d) 30 kJ**

(v) The heat emitted by a bulb of 1.90W in 1 min is

(a) 100 J **(b) 1000 J** **(c) 600 J** **(d) 6000 J**

811) When a conductor does not have a current through it, its conduction electrons move randomly, with no net motion in any direction. When the conductor does have a current through it, these electrons actually still move randomly, but now they tend to drift with a drift speed Vα in the direction opposite to the applied electric field that causes current. The drift speed is very small as compared to the speeds in the random motion. For example, in the copper r conductors of household wiring, electron drift speeds are perhaps 10^{-5} ms^{1} to 10^{-3} ms^{-1} where as the random speed is around 10^{6} ms^{-1} .

(i) The electron drift speed is estimated to be only a few mm S^{-1} for currents in the range of a few amperes? How is current established almost the instant a circuit is closed?

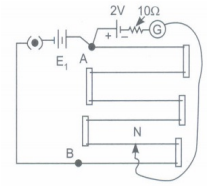
(ii) The electron drift arises due to the force experienced by electrons in the electric field inside the conductor. But force should cause acceleration. Why do the electrons acquire a steady average drift speed?

(iii) 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?

(iv) 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?

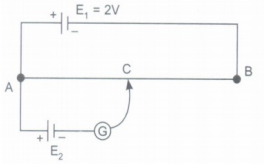
(v) Are the paths of electrons straight lines between successive collisions (with the positive ions of the metal) in the (a) absence of electric field, (b) presence of electric field?

812) A student while doing experiment connected six wire (600 cm) potentiameter to a cell of emf E, and a key, so that 50 mA current started flowing from A to B. Here A and B are two ends of a potentiameter wire. For a cell of emf 2 V and internal resistance 10 Ω , he found null point at 500 cm from A. But when he connected voltmeter across the cell, the balancing length is decreased by 10 cm.



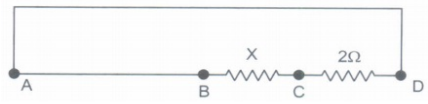
(i) What is the potential gradient along the wire?
(ii) Reading of voltmeter is _____
(iii) Determine the resistance of voltmeter.
(iv) Now, instead of a cell, if only voltmeter is connected with one end to point A and another end to sliding contact then plot variation of potential difference against length as sliding contact moves away from A. Which physical quantity will represent slope of this graph?

813) AB is a metre long wire of a potentiometer. On connecting a cell E_2 across AC (AC = 60 cm), no current flows from E_2 If internal resistance of cell E. is assumed to be negligible, then determine



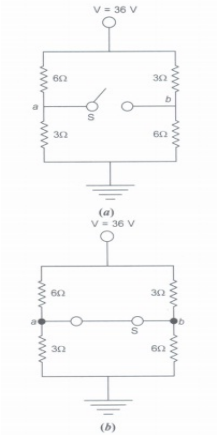
(i) Potential gradient along wire AB.
(ii) EMF of cell E_2
(iii) Will balancing point change if E_2 has same internal resistance?

814) (i) AB is a metre long wire having uniform cross sectional area. An unknown resistance X and a resistance of 2 Ω are connected by thick conducting strips. Connect a battery and a galvanometer to measure unknown resistance X using Wheatstone bridge principle.

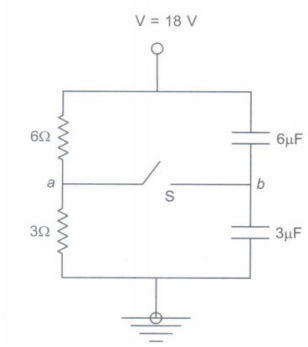


(ii) Assuming all the connections to be correct, if balance point is obtained at 40 cm from point A, then what is the value of resistance X?
(iii) If one more resistance of 6Ω is connected in parallel to X, then determine the balancing length.

815) In the figure given below, the battery (or other power supply) is not shown, but it is understood that the point at the top, labeled "36V", is connected to the positive terminal of a 36 V battery having negligible internal resistance, and the "ground" symbol at the bottom to its negative terminal. The circuit is completed through the battery, even though it is not shown on the diagram.
(i) In figure (a) what is the potential difference V_a - V_b when switch S is open?
(ii) What is the current through switch S, when it is closed?

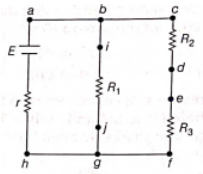


816)



(i) What is the potential difference between points a and b when switch S is open?
(ii) What are the potentials at points a and b when switch is closed?
(iii) How much charge will flow through capacitor of capacitance 6 IlF as soon as the switch S is closed?

817) An experiment was set-up with the circuit diagram shown in figure. Given that, R_1 = 10Ω, R_2 = R_3 = 5Ω, r = 0 Ω and E = 5V



(i) The points with the same potential are
(a) b, c, d**(b)** f, h, j**(c)** d, e, f**(d)** a, b, j
(ii) The current through branch bg is
(a) 1A(b) 1/3 A(c) 1/2 A(d) 2/3 A
(iii) The power dissipated in R_1 is
(a) 2W**(b) 2.5 W(c) 3 W(d) 4.5 W**
(iv) The potential difference across R_3 is
(a) 1.5 V(b) 2 V(c) 2.5 V(d) 3 V

5 Marks 96 x 5 = 480

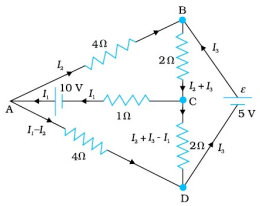
818) A storage battery of emf 8.0 V and internal resistance 0.5 Ω is being charged by a 120V dc supply using a series resistor of 15.5 Ω . What is the terminal voltage of the battery during charging? What is the purpose of having a series resistor in the charging circuit?

819) A heating element using nichrome connected to a 230 V supply draws an initial current of 3.2 A which settles after a few seconds to a steady value of 2.8 A. What is the steady temperature of the heating element if the room temperature is $27.0^{\circ}C$? Temperature coefficient of resistance of nichrome averaged over the temperature range involved is $1.70 \times 10^{-4\circ}C^{-1}$?

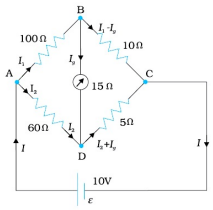
820) A battery of emf 10 V and internal resistance 3 Ω is connected to a resistor. If the current in the circuit is 0.5 A, what is the resistance of the resistor? What is the terminal voltage of the battery when the circuit is closed?

821) (a) Estimate the average drift speed of conduction electrons in a copper wire of cross-sectional area 1.0 x 10^{-7} m^2 carrying a current of 1.5 A. Assume that each copper atom contributes roughly one conduction electron. The density of copper is 9.0 x 10^3 kg/m^3, and its atomic mass is 63.5 u.
(b) Compare the drift speed obtained above with,
(i) thermal speeds of copper atoms at ordinary temperatures,
(ii) speed of propagation of electric field along the conductor which causes the drift motion.

822) Determine the current in each branch of the network shown in Figure.

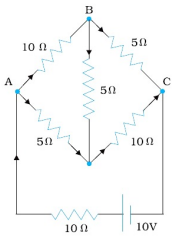


823) The four arms of a Wheatstone bridge Figure have the following resistances:
AB = 100Ω, BC = 10Ω, CD = 5Ω, and DA = 60Ω.

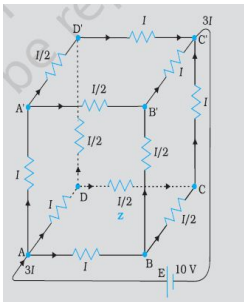


A galvanometer of 15Ω resistance is connected across BD. Calculate the current through the galvanometer when a potential difference of 10 V is maintained across AC.

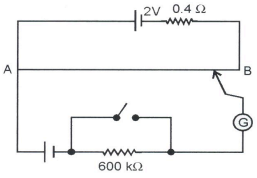
824) Determine the current in each branch of the network shown in Figure



825) 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 resistance 1 Ω (Figure). Determine the equivalent resistance of the network and the current along each edge of the cube.

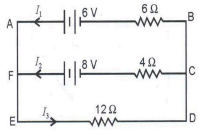


826) Figure shows a potentiometer with a cell of 2.0V and internal resistance of 0.40Ω maintaining a potential drop across the resistor wire AB. A standard cell which maintains a constant emf of 1.02V (for very moderate currents upto a few mA) gives a balance point at 67.3 cm length of the wire. To ensure very low currents drawn from the standard cell a very high resistance 600kΩ is put in series with it Which is shorted cell is then replaced by a cell of unknown emf E and the balance point found similarly, turns out to be at 82.3 cm length of the wire.

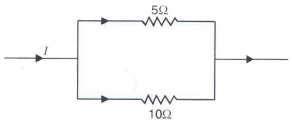


(a) What is the value E?
(b) What purpose does the high resistance o 600kΩ have?
(c) Is the balance point affected by this high resistance?
(d) Is the balance point affected by the internal resistance of 600kΩ have?
(e) Would the method work in the above situation if the driver cell of the potentiometer had an emf of 1.0V instead of 2.V?
(f) Would the circuit work well for determining an etremely small emf say of the order of a few mV (such as the typical emf of a thermo-couple)? If not how will you modiy the circuit?

827) In the network shown here find the following:
(a) Current I_1, I_2 and I_3
(b)Terminal potential difference of each battery.
Consider 6Ω to be the internal resistance of 6V battery and 4Ω to be internal resistance of 8V battery

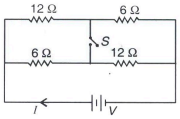


828) In the arrangement of resistors shown here, what fraction of I will pass through 5Ω resistor?

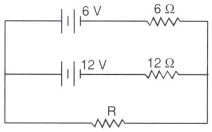


829) Two nichrome wires are connected in series with a battery. The length of nichrome wires are in the ratio of 1:2 whereas their resistance are in the ratio 2:1. Find the following
(a) ratio of their diameters
(b) ratio of drift velocity of free electrons in them.

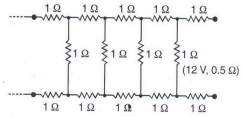
830) With switch S open the network of resistors shown here drawn a current I from the battery. How many times will this current become on closing the switch S?



831) In the circuit diagram shown here what should be the value of R so that there is no current in the branch containing 6V battery?



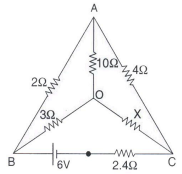
832) Determine the current drawn from a 12 V supply with internal resistance 0.5Ω by the infinite network shown in figure. Each resistor has 1Ω resistance.



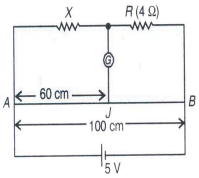
833) Two wires of equal length, one of aluminium and the other of copper have the same resistance. Which of the two wires in lighter? Hence explain why aluminium wires are preferred of overhead power cable. Al, ($\rho_1 = 2.63 \times 10^{-8}\Omega m,$ for Cu, $\rho_2 = 1.72 \times 10^{-8}\Omega m$. Relative density of Al = 2.7, of Cu = 8.9.)

834) Four identical cells, each of emf 2V are joined in parallel providing supply of current to external circuit consisting of two 15Ω resistors joined in parallel. The terminal voltage of the cells as read by an ideal voltmeter is 1.6V Calculate the internal resistance of each cell.

835) Find the value of the unknown resistance X, in the flowing circuit, if no current flows through the section AO. Also calculate the current drawn by the circuit from the battery of e.m.f. 6V and negligible internal resistance.



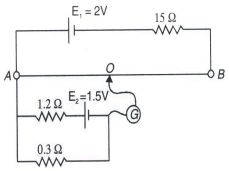
836) Calculate the value of unknown resistance X and the current drawn by the circuit assuming that no current flows through the galvanometer. Assume the resistance per unit length of the wire AB to be 0.01Ω /cm.



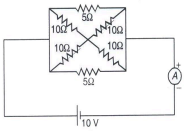
837) AB is 1m long uniform wire o 10Ω resistance. The other data are shown in the circuit diagram given below: Calculate

(i) Potential gradient along AB and

(ii) Length AO of the wire when the galvanometer shows no deflection.

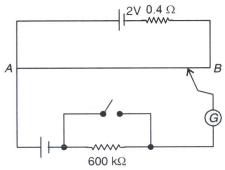


838) Calculate the current shown by the ammeter A in the circuit diagram given below:



839) Figure shows a potentiometer with a cell of 2.0V and internal resistance 0.40Ω maintaining a potential drop across the resistor wire AB. A standard cell which maintains a constant e.m.f. of 1.02V (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 $600k\Omega$ is put in series with it, which is shorted close to the balance point. The standard is then replaced by a cell of unknown e.m.f. E and the balance point found similarly, turns out to be at 82.3 cm length of the wire.

(a) What is the value o E?



(b) What purpose does the high resistance of $600k\Omega$ have?

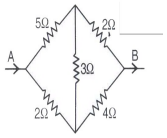
(c) Is the balance point affected by this high resistance?

(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 potentio-meter had an e.m.f of 1.0V instead of 2.0V?

(f) Would the circuit work cell for determining an extremely small e.m.f. say of the order of a few mV (such as the typical e.m.f. of a thermo-couple)? If not, how will you modify the circuit?

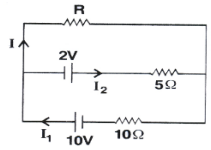
840) In the arrangement of conductors, find the equivalent resistance between A and B.



841) (a) Three resistors $2\ \Omega$, 4Ω 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.

842) Two cells of voltages 10V and 2V and internal resistances $10\Omega \; and \; 5\Omega$ respectively are connected in parallel with the positive end of 10V battery connected to negative pole of 2V battery. Find the effective voltage and effective resistance of the combination.



843) A room has AC run for 5 hours a day at a voltage of 220V. The wiring of the room consists of Cu of 1mm radius and a length of 10 m. Power consumption per day is 10 commercial units. What fraction of it goes in the joule heating in wires? What would happen, if the wiring is made of aluminiurn of the same dimensions? [Given, ρ_{Cu} = 1.7 x 10^{-8} Ω -m, ρ_{Al} = 2.7 x 10^{-8} Ω -m]

844) (a) Define electric current. What is its S.I. unit? Is it a scalar or a vector quantity? What is the direction of electric current?
(b) How many electrons flowing per second should flow to produce a current of 1A?

845) (a) State Ohm's law.
(b) Define resistance. Give its SI unit.

846) How will you establish the electrons carry current?

847) Establish the relation between current and drift velocity.

848) Deduce Ohm's law from the concept of a conductor of drift velocity.

849) Show that the resistance of a conductor is given by $R = \frac{ml}{ne^2A\tau}$

850) Show that the resistivity of a conductor is given by
$\rho = \frac{ml}{ne^2\tau}$

851) Explain how does the resistivity of a conductor depend upon
(i) number density 'n' of free electrons, and
(ii) relaxation time ρ ?

852) Define the term resistivity and write its S.I. unit. Derive the expression for the resistivity in terms of number density of free electrons and relaxation time.

853) Discuss the effect of temperature on the resistance of a conductor. Hence define the temperature coefficient of resistance. What is the unit of the temperature coefficient of resistance?

854) (a) Derive an expression for heat produced in a conductor for the flow of an electric current through it.
(b) What is the cause of heat produced?

855) (a) Define electric power, electric energy and give their units.
(b) What is relation between kWh and joule?

856) Explain how the cells are grouped in series? Obtain the condition for maximum current through an external resistor.

857) Explain how cells are mixed grouped?
Obtain the condition for maximum current through an external resistor.

858) A battery of 10 V and negligible internally resistance is connected across the diagonally resistance is connected across the diagonally opposite corners of a cubical network consisting of 12 resistors each of resistance 1Ω .
(i) the equivalent resistance of the network.
(ii) the total current in the network.

859) Show that one ampere is equivalent to flow of 6.25 x 10^{18} elementary electrons per second? Charge on electron = 1.6 x 10^{-19} C.

860) How many electrons pass through a lamp in 1 min, if the current is 300 mA? Given, the charge on an electron is 1.6 $\times$ 10^{-19}C.

861) If 10^6 electrons pass from a point A towards another point B in a conductor in one microsecond. Find the magnitude and direction of current. Given charge of an electron is 1.6×10^{-19} C.

862) In an atom an electron revolves around the nucleus in a circular orbit at the rate of 6×10^{15} revolutions per second. Calculate the equivalent current in milliampere. Take value of electronic charge = 1.6×10^{-19} C.

863) In a discharge tube, the number of protons drifting across a cross-section is 1.5×10^{18} per second, while the number of electrons drifting in opposite direction across that cross-section is 3.0×10^{18} per second. Find the total current crossing the given cross-section.

864) If 0.8 mole of electrons flow through a wire in 55 minutes. What is (a) the total charge in kilo coulomb that passes through the wire and (b) the magnitude of the current? Avogadro's number = 6×10^{23} per mole.

865) In a conductor, 10^{16} electrons move from a point A towards point B in 1 millisecond. 10^{14} positive ions move from a point B towards point A in 1 millisecond. What is the current in ampere and its direction? Charge on electron = charge on position ion = 1.6×10^{-19} C.

866) At room temperature copper has free electron density of 8.4×10^{28} per m^3. The copper conductor has a cross-section of 10^{-6} m^2 and carries a current of 5.4 A. What is the electron drift velocity in copper?

867) The number of free electrons per 100 mm of ordinary copper wire is 2×10^{21}. The average drift speed of electrons is 0.25 mm/s. What is the current flowing?

868) A copper wire of diameter 1.0 mm carries a current of 0.2 A. Copper has 8.4×10^{24} atoms per cubic metre. Find the drift velocity of electrons, assuming that one charge carrier of 1.6×10^{-19} C is associated with each atom of the copper.

869) A 60 coulomb of charge flows through a wire in half minute. The radius of the wire is 1 mm. The wire contains 5×10^{22} electrons per cubic centimetre. Calculate the current and drift velocity.

870) A current of 3 A is flowing through a wire of length 2 m and cross-sectional area 1 mm^2. If wire contains 10^{29} electrons/m^3, calculate the average time taken by an electron to cross the length of the wire.

871) There is a copper wire of length 2.2 m, of area of cross-section 2.0 sq. mm, carrying a current of 6.0 A. If the number density of electrons in copper is 8.5×10^{28} m^{-3} , find the time taken by an electron to drift from one end to another end of the wire.

872) What is the drift velocity for the electrons in a conductor when an electric field of strength 200 V/m is applied on it and mobility of electrons is 4.5×10^{-6} $m^2V^{-1}s^{-1}$?

873) Find the current flow through a copper wire of length 0.2 m, area of cross-section 1 mm^2, when its connected to a battery of 4 V. Given that electron mobility = 4.5×10^{-6} $m^2s^{-1}V^{-1}$ and charge on electron = 1.6×10^{-19} C. The number density of electron in copper is 8.5×10^{28} m^{-3}.

874) A wire of resistance $5.0\ \Omega$ is used to wind a coil of radius 5 cm. The wire has a diameter 2.0 mm and the specific resistance of its material is 2.0×10^{-7} Ωm . Find the number of turns in the coil.

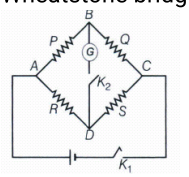
875) A wire of $10\ \Omega$ resistance is stretched to thrice its original length. What will be its
(i) new resistivity and
(ii) new resistance?

876) That night Vaikunth was preparing for his physics exam. Suddenly, the light in his room went off and he could not continue his studies. His cousin brother Vasu who had come to visit him was quick to react. Vasu using the torch (an android application) installed in his mobile phone found that the fuse had blown out. He checked the wiring and located a short circuit. He checked the wiring and located a short circuit. He rectified it and put a fuse wire. The light came to life again. Vaikunth had a sign of releif and continued his studies.
Read the above passage and answer the following question.
(i) What are the values projected by Vaikunth and Vasu?
(ii) Why did Vasu have to check the wiring?
(iii) What is an electric fuse? What characteristics you would prefer for a fuse wire?

877) Ramaniamma was a childless window. She ran her life only by the pension for the Sr. citizens from the Government. When she switches ON one bulb in her house, all the other appliances get switched OFF. She could not even spend for an electrician. Sujatha living nearby decided to do something for her. She referred to Physics books and learned that the series combination for the household connection could be the reason. She called an electrician and had the circuit changed to parallel combination. The problem was solved and Ramaniamma was happy. She thanked Sujatha for her help to solve the problem.
Read the above passage and answer the following questions.
(i) What are the values possessed by Sujatha?
(ii) Why a parallel combination is used for household? Give two advantages.

878) Vishwajeet purchased cells for his transistor. He felt that cells are not working properly. He wanted to check their emf. So, he took the cells to the physics lab and with the help of potentiometer found their emf. To his surprise, emf was less than the value claimed by the manufacturer. He lodged the complaint with consumer forum and received the deserving response.
Read the above passage and answer the following question.
(i) What values are displayed by Vishwajeet?
(ii) Why do you think Vishwajeet used potentiometer instead of voltmeter to find out emf of the cell? For more precise measurement, the potential gradient of the potentiometer should be high or low?

879) The unknown resistance of a conductor can be determined by Wheatstone bridge. The standard form of Wheatstone bridge is shown in the figure. It can be shown when the bridge is balanced.

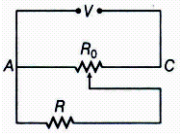


$\frac{P}{Q} = \frac{R}{S} \quad or \quad S = \frac{Q}{P}R$

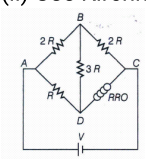
Knowing P,Q and R, unknown resistance S can be calculated.
Read the above passage and answer the following questions.
(i) Name any two applications of Wheatstone bridge.
(ii) What is the practical utility of the post office box in day to day life?

880) (i) In a meter bridge, the balance point is found to be at 39.5 cm from the end A, if an unknown resistor X is in the left gap and a known resistor Y of resistance 1.25 Ω is in the right gap. Determine resistance of X. Why are the connections between resistors in a Wheatstone or meter bridge made of thick copper strips?
(ii) Determine the balance point of the above bridge, if X and Y are interchanged.
(iii) What happens, if the galvanometer and cell are interchanged at the balance point of the bridge? would the galvanometer show any current?

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



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



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

883) (a) Define the term 'drift velocity' of charge carriers in a conductor. Obtain the expression for the current density in terms of relaxation time.

(b) A 100 V battery is connected to the electric network as shown. If the power consumed in the 2Ω resistor is 200 W, determine the power dissipated in the 5Ω resistors.