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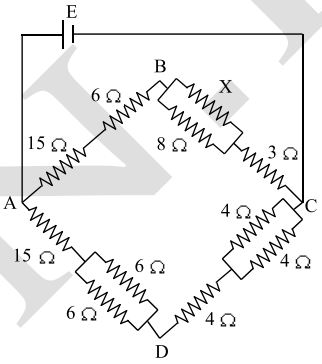
TEST ID: 55
PHYSICS

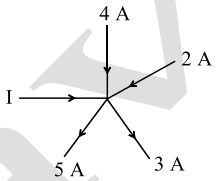
4.CURRENT ELECTRICITY,9.CURRENT ELECTRICITY

Single Correct Answer Type

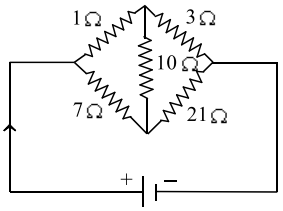
1. A potentiometer wire of length 100 cm has a resistance of 10 Ω. It is connected in series with a resistance and an accumulator of e.m.f. 2 V and of negligible internal resistance. A source of e.m.f. 10 mV is balanced against a 40 cm length of the potentiometer wire. The value of the external resistance is
   a) 395 Ω b) 790 Ω c) 405 Ω d) 810 Ω
2. What is the nature of the graph between temperature and the thermo emf ?
   a) Hyperbola
   b) Straight line
   c) Parabola
   d) Rectangular hyperbola
3. The potential gradient along the length of uniform wire is 10 Vm^{-1}. The length of the wire is 1 m. What is the potential difference across two points on the wire separated by 25 cm?
   a) 2.5 V b) 5.0 V c) 7.5 V d) 10 V
4. The material of wire of potentiometer is
   a) Copper b) Steel
   c) Manganin d) Aluminium
5. In the figure given below, what is the value of resistance X, when the potential difference between B and D is zero?



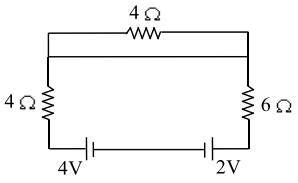
   a) 4 ohm b) 6 ohm c) 8 ohm d) 9 ohm
6. An electron in potentiometer wire experiences a force 2.4×10^{-19}N. The length of potentiometer wire is 6 m. The e.m.f. of the battery connected across the wire is (electronic charge $= 1.6 \times 10^{-19}$C)
   a) 6 V b) 9 V c) 12 V d) 15 V
7. In a potentiometer circuit, all the +ve terminals should be connected at
   a) One point b) Different points
   c) Alternate points d) Either 'b' or 'c'
8. The unit of potential gradient is
   a) Volt cm b) Ohm cm
   c) Volt/cm d) Volt/ampere
9. In the given current distribution, what is the value of I?



   a) 3 A b) 8 A c) 2 A d) 5 A
10. In the circuit shown, the current drawn from the battery is 4 A. If 10 Ω resistor is replaced by 20 Ω resistor, the current drawn from the circuit will be



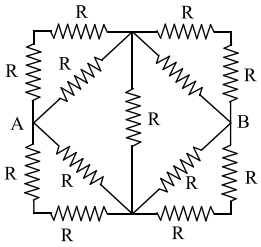
    a) 1 A b) 1.5 A c) 3 A d) 3.5 A
11. The resistances in left and right gap of a meter-bridge are 20 Ω and 30 Ω respectively. When the resistance in the left gap is reduced to half its value, the balance point shifts by
    a) 15 cm to the right b) 15 cm to the left
    c) 20 cm to the right d) 20 cm to the left
12. When a current passes through the junction of two different metals, evolution or absorption of heat at the junction is known as
    a) Joule effect b) Seebeck effect
    c) Peltier effect d) Thomson effect
13. The current through the 6 Ω resistor shown in figure is



a) 0.1 A b) 0.2 A c) 0.3 A d) 0.4 A

14. S.I. unit of Thomson Coefficient is…….
a) J/C b) J/K c) V/C d) V/K

15. Thirteen resistances each of resistance R ohm are connected in the circuit as shown in the figure below. The effective resistance between A and B is



a) 2R Ω b) $\frac{4R}{3}$ Ω c) $\frac{2R}{3}$ Ω d) R Ω

16. When different parts of a metal are kept at different temperatures and current is passed through it, the heat is either evolved or absorbed. This effect is called
a) Seebeck effect b) Thomson effect
c) Peltier effect d) Faraday effect

17. Wheatstone's bridge is more sensitive when all the four resistances are in
a) Different order
b) Same order
c) Partially different order
d) No connection with the order

18. A potentiometer wire of length 10 m is connected in series with a battery. The e. m. f. of a cell balances against 250 cm length of wire. If length of potentiometer wire is increased by 1 m, the new balancing length of wire will be
a) 2.00 m b) 2.25 m c) 2.50 m d) 2.75 m

19. The Resistance of conductor increases with temperature due to
a) Change in current carrier
b) Change in dimensions
c) Increase in number of collision
d) Increase in rate of collision

20. A potentiometer has uniform potential gradient across it. Two cells connected in series (i) to support each other and (ii) to oppose each other are balanced over 6 m and 2 m respectively on the potentiometer wire. The e.m.f.s of the cells are in the ratio of
a) 1 : 2 b) 1 : 1 c) 3 : 1 d) 2 : 1

21. The seebeck thermoelectric series for few metals is as follows :
a) $e_1 > e_2$ b) $e_1 < e_2$
c) $e_1 = e_2$ d) Data insufficient

22. A thermo galvanometer can measure
a) Alternating currents b) Direct currents
c) Both 'a' and 'b' d) None of these

23. Four resistors P, Q, R and S having resistances 2 Ω, 2 Ω, 2 Ω and 3 Ω respectively, are arranged to form a Wheatstone's bridge. The value of the resistance with which S must be shunted in order to balance the bridge is
a) 2 Ω b) 3 Ω c) 4 Ω d) 6 Ω

24. Amount of energy absorbed or evolved when 1 A of current passes for one second through a junction of two metals is called
a) Peltier coefficient
b) Thermo e. m. f.
c) Thomson coefficient
d) Thermoelectric power

25. If for a thermocouple T_n is the neutral temperature, T_c is the temperature of the cold junction and
T_i is the temprature of inversion, then
a) $T_i = 2T_n - T_c$ b) $T_n = T_i - 2T_c$
c) $T_i = T_n - T_c$ d) None of these

26. A thermoelectric refrigerator works on
a) Joule effect b) Seebeck effect
c) Thomson effect d) Peltier effect

27. For the validity of Ohm's law, which of the following quantity is constant ?
a) Length b) Temperature
c) Area of cross-section d) All of these

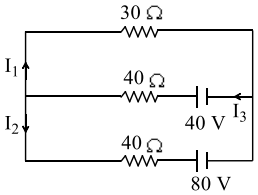
28. In a closed circuit, the vector sum of total e. m. f. s is equal to the sum of the
a) Currents
b) Resistances
c) Products of current and the resistances
d) Internal resistance of cell

29. Potentiometer measures potential more accurately, because
a) It uses sensitive galvanometer for null deflection
b) It uses high resistance potentiometer wire.
c) It measures the potential in the closed circuit.
d) It measures the potential in open circuit.

30. Potentiometer is better for measuring the potential difference than the voltmeter because

a) It uses a long wire
b) It uses an auxiliary battery of large e.m.f.
c) It does not disturb the potential difference to be measured
d) It is based on the principle of Wheatstone bridge

31. In the given circuit, the current I_1 is



a) 0.4 A b) −0.4 A c) 0.8 A d) −0.8 A

32. A potentiometer has uniform potential gradient. The specific resistance of the material of the potentiometer wire is 10^{-7} ohm-metre and the current passing through it is 0.1 ampere; cross-section of the wire is 10^{-6} m^2. The potential gradient along the potentiometer wire is
a) 10^{-4} V/m b) 10^{-6} V/m
c) 10^{-2} V/m d) 10^{-8} V/m

33. According to the Kirchhoff's laws in an electric circuit, the algebraic sum of current at any junction is
a) Negligible b) Zero
c) Infinite d) Finite

34. Ohm's law is applicable to
a) Metals b) Electrolytes
c) Both 'a' and 'b' d) None of these

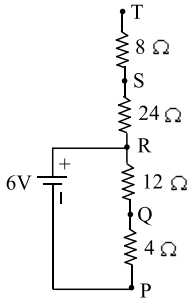
35. In the measurement of resistance by a metre bridge, the known and unknown resistance are interchanged to eliminate
a) End errors
b) Index error
c) Random error
d) Error due to thermoelectric effect

36. In a metrebridge, the balancing length from the left end (standard resistance of one ohm is in the right gap) is found to be 20 cm. The value of the unknown resistance is
a) 0.8 Ω b) 0.5 Ω c) 0.4 Ω d) 0.25 Ω

37. Kirchhoff's current law is the law of conservation of
a) Energy b) Momentum
c) Charge d) Angular momentum

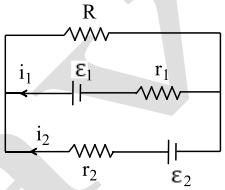
38. Which of the following instruments is generally used with a galvanometer to show null reading?
a) Ammeter b) Potentiometer
c) Voltmeter d) Metrebridge

39. Figure (i) drawn below shows how four resistors are connected. A 6 V cell is connected between points P and R. If the cell has negligible internal resistance, the P.D. between points Q and S is



a) 0 V b) 2 V c) 4 V d) 6 V

40. See the electrical circuit shown in this figure. Which of the following equations is a correct equation for it?



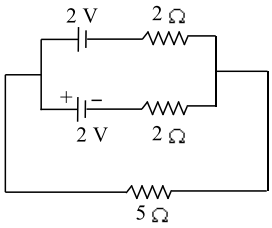
a) $\varepsilon_1 - (i_1 + i_2)R - i_1 r_1 = 0$
b) $\varepsilon_2 - i_1 i_2 - \varepsilon_1 - i_1 r_1 = 0$
c) $-\varepsilon_2 - (i_1 + i_2)R + i_2 r_2 = 0$
d) $\varepsilon_1 - (i_1 + i_2)R + i_1 r_1 = 0$

41. In a metrebridge, copper strips are used to
a) Decrease contact resistance
b) To reduce thermoelectric effect
c) To increase grip of wire
d) None of these

42. An unknown resistance R_1 is connected in series with a resistance of 10Ω. This combination is connected to one gap of a metrebridge while a resistance R_2 is connected in the other gap. The balance point is at 50 cm. Now, when the 10 Ω resistance is removed the balance point shifts to 40 cm. The value of R_1 is (in ohm)
a) 60 b) 40 c) 20 d) 10

43. The resistance of the material of unit length and unit area of cross section is
a) Specific resistance b) Conductance
c) Inductance d) Capacitance

44. In the circuit shown, the current through the 5 Ω resistor is



a) $\frac{8}{3}$A b) $\frac{9}{13}$A c) $\frac{4}{13}$A d) $\frac{1}{3}$A

45. A potentiometer wire has a resistivity of 10^9 Ω cm and area of cross-section is 10^{-2}cm^2. If current of 0.01 mA passes through the wire, potential gradient is
a) 10^9 V/m b) 10^{10} V/m
c) 10^{11} V/m d) 10^8 V/m

46. Charge carries in the thermo-couple are
a) Electron b) Protons c) +ve ions d) -ve ions

47. The e. m. f. of two cells can be compared by
a) Potentiometer b) Ammeter
c) Luxmeter d) Speedometer

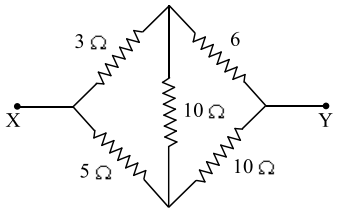
48. A potentiometer wire is 10 m long and has a resistance of 2 Ω/m. It is connected in series with a battery of e.m.f. 3 V and a resistance of 10 Ω. The potential gradient along the wire in V/m is
a) 0.01 b) 0.02 c) 0.1 d) 0.2

49. Which of the following instrument is generally used with a galvanometer to show nil reading ?
a) An ammeter b) A voltmeter
c) A voltmeter d) A metre bridge

50. In a metrebridge, when R_1 and X are the resistances in left gap and right gap respectively, the null point is obtained at 40 cm from the left. Now, when the resistance R_2 is in left gap and X in right gap, then the null point is obtained at 60 cm from the left. When the resistance in left gap is changed to $(R_1 + R_2)$, the null point will be at
a) 25.6 cm from left b) 68.4 cm from left
c) 31.6 cm from left d) 74.4 cm from left

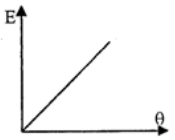
51. For a given temperature difference, which of the following pairs will generate maximum thermo emf
a) Antimony-bismuth b) Silver-gold
c) Iron-copper d) Lead-nickel

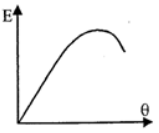
52. In the circuit given below, the effective resistance between the points X and Y is

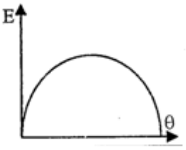


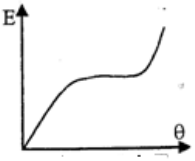
a) $\frac{45}{4}$Ω b) $\frac{45}{8}$Ω c) $\frac{45}{16}$Ω d) $\frac{25}{2}$Ω

53. Which of the following graphs represent the variation of thermo e. m. f. (E) of a thermocouple with temperature θ of hot junction (the cold junction being kept of 0°C ?

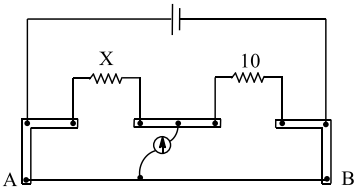
a) 

b) 

c) 

d) 

54. A metrebridge is set-up as shown, to determine an unknown resistance 'X' using a standard 16 ohm resistor. The galvanometer shows null point when tapping-key is 52 cm mark. The end-corrections are 1 cm and 2 cm respectively for the ends A and B. The determined value of 'X' is



a) 10.2 ohm b) 10.6 ohm c) 10.8 ohm d) 11.1 ohm

55. With resistances P and Q in the left and right gaps of a metre bridge, the balance point divides the wire in the ratio 1/3. When P and Q are increased by 40 Ω, the balance point divides the wire in the ratio 3/5. The values of P and Q will be respectively
a) 30 Ω, 10 Ω b) 10 Ω, 30 Ω
c) 20 Ω, 60 Ω d) 60 Ω, 40 Ω

56. Select the WRONG statement
a) A potentiometer is a constant voltage device
b) A potentiometer is a constant current device
c) A potentiometer is used to measure e. m. f. to a cell
d) A potentiometer is used to measure potential drop between two points in an electric circuit

57. If the resistance of the right gap of a metre

bridge is heated, its balance point shifts to

a) The left b) The middle

c) The right d) Any point

58. Wheatstone's bridge is an arrangement used for measuring

a) e. m. f. of a cell b) Unknown resistance

c) Unknown current d) Potential difference

59. Accuracy of a metrebridge is maximum when the null point is obtained at the midpoint of the bridge wire. This is because

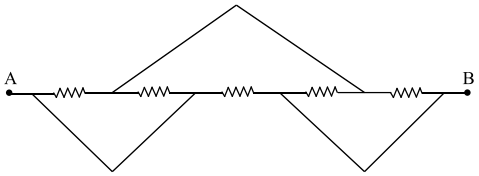
a) The error due to non uniformity of diameter of the wire is minimum in that case

b) The error due to the end resistances is minimum

c) The error due to heating up of wire is minimum

d) The error due to faulty galvanometer is minimum

60. Resistors, each of value 2 Ω, are arranged as shown in figure. The equivalent resistance between points A and B is



a) 1Ω b) $\frac{1}{3}\Omega$ c) $\frac{5}{2}\Omega$ d) $\frac{2}{5}\Omega$

61. Thermocouple is an arrangement of two different metals to convert

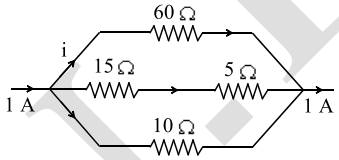
a) Heat energy into electrical energy

b) Electrical energy into chemical energy

c) Electrical energy into heat energy

d) Heat energy into chemical energy

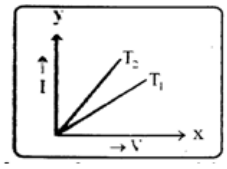
62. The magnitude of i in ampere unit is



a) 0.1 b) 0.3

c) 0.6 d) None of these

63. The I-V (current-voltage) graphs are shown for two temperature T_1 and T_2, it is concluded that :



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

64. Thomson coefficient σ, temperature T (in Kelvin) & Seebeck coefficient S are related as

a) $\sigma = T\frac{dS}{dT}$ b) $T = \sigma\frac{dS}{dT}$ c) $T = \frac{\sigma}{S}$ d) $\sigma = \frac{S}{T}$

65. Inversion temperature of thermocouple depends upon :

a) Neutral temperature

b) Temperature of cold junction and material used in thermocouple

c) Experimental arrangement

d) Temperature of surrounding air

66. When a balance point is obtained in a potentiometer for finding the internal resistance of a cell, the current through the potentiometer wire is due to

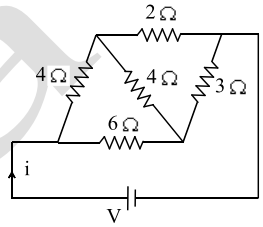
a) The cell whose internal resistance is to be found

b) The auxiliary battery

c) Both cell and auxiliary battery

d) Neither cell nor the battery

67. For the network shown in the figure, the value of the current i is

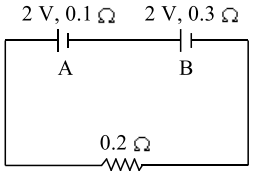


a) $\frac{9V}{35}$ b) $\frac{5V}{18}$ c) $\frac{5V}{9}$ d) $\frac{18V}{5}$

68. Thermoelectric effect was discovered by

a) Thomso n b) Peltier c) Seebeck d) Kelvin

69. The internal resistances of two cells shown are 0.1 Ω and 0.3 Ω. If R = 0.2 Ω, the potential difference across the



a) Cell B will be zero and A will be less than 2 V

b) Cell A will be zero and B will be greater than 2 V

c) Cells A and B will be 2 V

d) Cell A will be > 2 V and B will be < 2 V

70. The relation between current and potential difference is given by

a) Ohm's law b) Coulomb's law

c) Kirchhoff's law d) Newton's law

71. Thermoelectric pyrometers are used for measuring

a) Very low temperatures
b) Low temperatures
c) High temperatures
d) To measure the temperature very accurate

72. If one junction of a thermocouple is heated and other junction is cooled continuously in the same steps, the e. m. f. will
a) Increase and then decrease
b) Increase then decrease and finally reverse
c) No change at all
d) Change appreciably.

73. If 'n' is the number of free electrons in a metallic wire, then the resistance is proportional to
a) $1/n^2$ b) $1/n$ c) n^2 d) n

74. A potentiometer is more sensitive when
a) Its wire is of small length
b) Its wire is of large length
c) Applied P.D. is large
d) Potential gradient along the wire is very low

75. In a potentiometer experiment, for measuring internal resistance of a cell, the balance point has been obtained on fourth wire. The balance point can be shifted to fifth wire by
a) Decreasing the current due to auxiliary battery
b) Increasing the current due to auxiliary battery
c) Putting a suitable resistance in series to the cell
d) Putting a shunt resistance in parallel to the cell

76. The balancing lengths for the cells of e. m. f. E_1 and E_2 are l_1 and l_2 respectively. If they are connected separately then
a) $\frac{E_1}{E_2} = \frac{l_1}{l_2}$ b) $\frac{E_1}{E_2} = \frac{l_1 + l_2}{l_1 - l_2}$
c) $\frac{E_1}{E_2} = \frac{l_1 + l_2}{l_2}$ d) $\frac{E_1}{E_2} = \frac{l_1 - l_2}{l_2}$

77. Thermopile is used for
a) Collecting the heat energy
b) The measurement of radiant heat energy
c) The measurement of radiant heat energy
d) The change of atomic energy into heat energy

78. Which of the following can cause the null point of a potentiometer to shift beyond the wire ?
a) Law e. m. f. driver cell
b) High e. m. f. driver cell
c) Shorter length of wire
d) Longer length of wire

79. The sensitivity of the wheatstone's bridge depends upon the value of
a) Current b) Voltage
c) Resistance d) All of these

80. What will be the change in potential gradient if the wire if one wire is replaced by another wire of double diameter in potentiometer experiment if initial potential gradient is V_0.
a) V_0 b) $2\ V_0$ c) $V_0/2$ d) 0

81. Kirchhoff's second law is applicable to :
a) Current in a circuit
b) Potential difference only
c) e. m. f. only
d) Potential difference and current

82. Kirchhoff's laws are related to the law of conservation of
a) Mass b) Momentum
c) Energy d) All of these

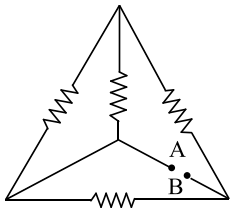
83. A battery is connected to a thermocouple of copper and iron. The two junctions will be
a) At the same temperature
b) Heated up
c) Neither heated up nor cooled
d) Undergoing thermo electric effect leading to the heating of one junction and cooling of the other

84. The Peltier coefficient of a thermo couple of metals A and B at junction temperature T is given by
a) $T^2 \frac{dE}{dT^2}$ b) $T \frac{dE}{dT}$ c) $T^3 \frac{dE^2}{d}$ d) $T^4 \frac{d^2E}{dT^2}$

85. What determines the conventional direction of the product of current and resistance while applying the Kirchhoff's laws?
a) Magnitude of current b) Value of resistance
c) Direction of current d) Value of P.D.

86. Thermopile is used to
a) Measure of emf
b) Measure the current
c) Convert electrical energy to heat energy
d) Detect heat radiation

87. In the network shown in the figure, each of the resistance is equal to 2 Ω. The resistance between the points A and B is



a) 1 Ω

b) 4 Ω
c) 3 Ω
d) 2 Ω

88. Wheatstone bridge is an arrangement used for measuring
a) Potential difference b) Emf of cell
c) Current d) Unknown resistance

89. The V-graph for a conductor makes angle θ with y-axis. Here V denotes voltage and I denote current. The resistance of the conductor is given by
a) Sin θ b) Cos θ c) Tan θ d) Cot θ

90. A battery of e. m. f. 2 V and internal resistance 2 Ω is connected to an external resistance 8 Ω. If the length of the conductor is 4 m, then potential gradient between the two ends of the wire is
a) 0.4 V/m b) 8 V/m c) 4 V/m d) 2 V/m

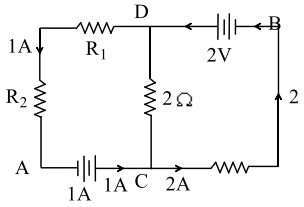
91. In the Seebeck series Bi occurs first following by Cu and Fe among other. The Sb is last in the series. If E_1 be the thermo emf at the given temperature difference for Cu-Fe thermocouple and E_2 be that for Bi-Sb thermocouple, which of the following is true ?
a) $E_1 = E_2$
b) $E_1 > E_2$
c) $E_1 < E_2$
d) Data is not sufficient to predict it

92. The conversion which takes place in seebeck effect is
a) Electrical energy into heat energy
b) Heat energy into electrical energy
c) Heat energy into mechanical energy
d) Heat energy into light energy

93. Amount of heat energy absorbed or evolved when 1 A of current passes for 1 second through a portion of metal kept at a temperature difference of 1°C is called
a) Thermo e. m. f.
b) Thomson co-efficient
c) Thermoelectric power
d) Peltier coefficient

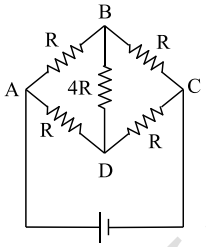
94. An accumulator of 5 volt is connected through a resistance of 40 Ω to a potentiometer wire 10 m long and of resistance 10 Ω. For a cell, the null point is found at a length of 8 m from the common terminal. The current through the wire is
a) 0.05 A b) 0.1 A c) 0.15 A d) 0.2

95. In the circuit shown in the figure, if the potential at point A is taken to be zero, the potential at point B is



a) −2V b) +1V c) −1V d) +2V

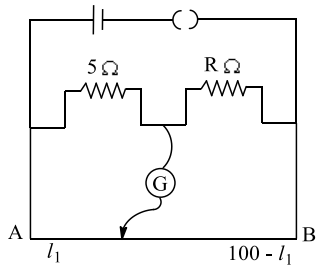
96. Five resistors of given values are connected together as shown in the figure. The current in the arm BD will be



a) Half the current in the arm ABC
b) Zero
c) Twice the current in the arm ABC
d) Four times the current in the arm ABC

97. In potentiometer experiment to determine internal resistance of the cell, balance point has been obtained in fourth wire. It can be shifted to 5^{th} wire by
a) Decreasing the current through potentiometer wire
b) Increasing the current through potentiometer wire
c) Connecting suitable shunt resistance across the cell
d) Connecting a resistance in series with the cell

98. The resistances in the two arms of the meter bridge are 5 Ω and R Ω, respectively. When the resistance R is shunted with an equal resistance, the new balance point is at 1.6 l_1. The resistance R, is



a) 10 Ω b) 15 Ω c) 20 Ω d) 25 Ω

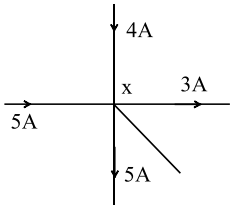
99. In potentiometer experiment, the balancing length of wire should be measured from :
a) Its positive end
b) Its negative end
c) Its positive or negative end

d) Any point on the wire

100. Null point of a potentiometer wire will shift beyond the potentiometer wire if
a) The e. m. f. of driving cell is low
b) The length of the wire is small
c) The e. m. f. of accumulator is high
d) The length of the wire s large

101. In a Wheatstone's metrebridge, the null point is obtained at the middle point of the wire. If in one gap the resistance is 10 Ω, then the value of resistance in the other gap is
a) 10 Ω b) 5 Ω c) 1/5 Ω d) 500 Ω

102. Five conductors are meeting at a point x as shown in the figure. What is the value of current in fifth conductor?



a) 3 A away from x b) 1 A away from x
c) 4 A away from x d) 1 A towards x

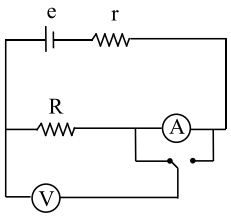
103. Which of the following can cause the null point of a potentiometer to shift beyond the wire?
a) Low e. m. f. of auxiliary battery
b) High e. m. f. of auxiliary battery
c) Shorter length of wire
d) Longer length of wire

104. Length of conductor is doubled, its conductance will be :
a) Doubled b) Quadrupled
c) Unchanged d) Halved

105. A resistance of 990 Ω and a cell of emf 2 V is connected in series with a potentiometer wire having a length 2 m and resistance 10 Ω. The potential gradient along the wire will be
a) 0.01 V/m b) 0.02 V/m
c) 0.03 V/m d) 0.04 V/m

106. In a closed circuit, the e. m. f. and internal resistance of the generator are E and r respectively. If the external resistance in the circuit is R, then Ohm's law has the form
a) $I = \frac{E}{Rr}$ b) $I = \frac{E}{R}$
c) $I = \frac{E}{r}$ d) $I = \frac{E}{(R + r)}$

107. The e.m.f. e and the internal resistance r of the battery shown in figure and 4.3 V and 10 Ω respectively. The external resistance R is 50 Ω. The resistance of the ammeter and voltmeter are 2.0 Ω and 200 Ω respectively. If the switch is thrown to the other side, the reading of the ammeter will be



a) 0.02 A b) 0.04 A c) 0.08 A d) 0.12 A

108. As the temperature of hot junction increases, the thermo e. m. f.
a) Always increases
b) Always decreases
c) May increase or decrease
d) Always remains constant

109. Four resistances arranged to form a Wheatstone network are 8 Ω, 12 Ω, 6 Ω and 27 Ω. The resistance should be shunted across 27 Ω resistance, so that the bridge is balanced is
a) 13.5 Ω b) 14.5 Ω c) 13 Ω d) 14 Ω

110. 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

111. In Kelvin's method of finding the resistance of a galvanometer, we
a) Use the balance point method
b) Use the null point method
c) Use the half deflection method
d) Interchange the positions of the battery and the galvanometer

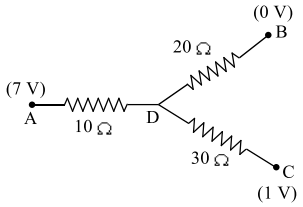
112. Sensitivity of a particular potentiometer can be increased by
a) Increasing the potential gradient along the wire
b) Decreasing the potential gradient along the wire
c) Increasing the current through the wire
d) Decreasing the current through the wire

113. Thermoelectric series help us to find
a) The direction of thermoelectric current in a thermocouple
b) The strength of electron bonds in two different metals
c) Mass of the substance deposited per 1A of current

d) To generate more and more heat energy

114. According to Kirchhoff's law, the algebraic sum of the products of current and resistance as well as e. m. f. s in a closed loop is
a) Greater than zero
b) Zero
c) Less than zero
d) Determined by the e. m. f.

115. In the network shown in the figure, points A, B and C are at potentials of 7 V, 0 V and 1 V respectively. Which of the following statements is INCORRECT?



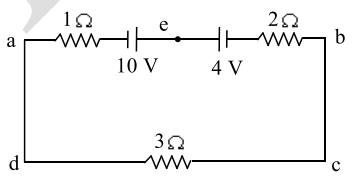
a) Point D is at a potential of 4 V
b) The currents in the sections AD, DB, DC are in the ratio 3 : 2 : 1
c) The currents in the sections AD, DB, DC are in the ratio 1 : 2 : 3
d) The network draws total power 2.00 W

116. A potentiometer consists of a wire of length 4 m and resistance 10 Ω. It is connected to a cell of e.m.f. 2 V. The potential difference per unit length of the wire will be
a) 0.5 V/m b) 10 V/m c) 2 V/m d) 5 V/m

117. If temperature of cold junction of thermocouple is lowered, then its neutral temperature will :
a) Decrease
b) Increase
c) Remain same
d) Approach to inversion temperature

118. Kirchhoff's first law is applicable to only :
a) Closed circuit
b) At common point of network
c) Open circuit
d) Alternating circuit

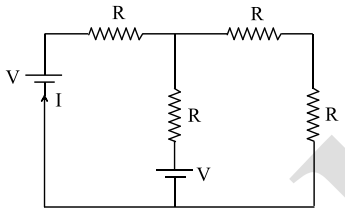
119. The magnitude and direction of the current in the circuit shown will be



a) $\frac{7}{3}$ A from a to b through e
b) $\frac{7}{3}$ A from b to a through e
c) 1 A from b to a through e
d) 1 A from a to b through e

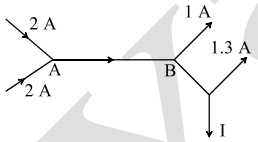
120. Metre bridge is used to
a) Determine unknown resistance
b) Measure current
c) Measure P.D .
d) All of these

121. In the given circuit, the current I equal to



a) $\frac{V}{5R}$ b) $\frac{V}{4R}$ c) $\frac{2V}{5R}$ d) 0

122. The figure below shows currents in a part of electric circuit. The current I is



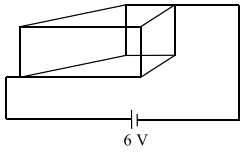
a) 1.7 A b) 3.7 A c) 1.3 A d) 1 A

123. In a potentiometer experiment, when three cells A, B and C are connected in series, the balancing length is found to be 740 cm. If A and B are connected in series, balancing length is 440 cm and for B and C connected in series, it is 540 cm. The emf of E_A, E_B and E_C are respectively (in volts)
a) 1, 1.2 and 1.5 b) 1, 2 and 3
c) 1.5, 2 and 3 d) 1.5, 2.5 and 3.5

124. The sensitivity of Wheatstones network depends upon the value of
a) Current b) Resistance
c) Voltage d) All of these

125. If the radius of a potentiometer wire is increased four times, keeping its length constant, then the value of a potential gradient will become
a) Four times b) Two times
c) Half d) Constant.

126. A battery of 6V and negligible internal resistance is connected across the diagonally opposite corners of a cubical network consisting of 12 resistors each of resistance 2 Ω



The current through the battery is
a) 1 A b) 3.6 A c) 7.2 A d) 12 A

127. The potentiometer wire of resistance R is connected in series with a cell of e. m. f. E and of internal resistance r along with external resistance R_h. The current flowing through the potentiometer wire is

a) $I = \frac{E}{R + r + R_h}$ b) $I = \frac{E}{R + r}$

c) $I = \frac{RE}{R_h + r}$ d) $I = \frac{E}{R}$

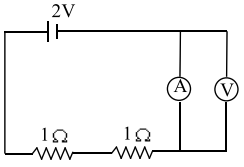
128. In comparing e. m. f. of two cells by a potentiometer balance point is obtained on 5th wire, the current flowing through the wire is taken

a) From both cells
b) From one cells
c) From the main battery of circuit
d) None of these

129. Kirchhoff's laws are used to calculate currents and potential differences in

a) Simple circuits b) Parallel circuits
c) Complicated circuits d) Long circuit

130. In the circuit shown, A and V are ideal ammeter and voltmeter respectively. Reading of the voltmeter will be



a) 2 V b) 1 V c) 0.5 V d) Zero

131. A certain wire is made up into two squares with a common side of length 5 cm. A current enters the rectangular network at one of the corners and leaves at the diagonally opposite corner. The current in the common side in terms of the entering current is

a) I/2 b) I/3 c) I/4 d) I/5

132. The instrument which is the combination of thermo couple and sensitive galvanometer is

a) Boy's radio micrometer
b) Sensitive galvanometer
c) Super thermometer
d) Potentiometer

133. Specific resistance of all metals is mostly affected by

a) Volume b) Pressure
c) Temperature d) Magnetic filed

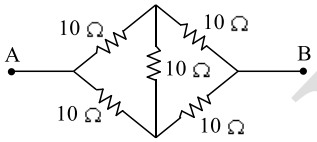
134. A cell of e.m.f 2 V and negligible internal resistance is connected in series with a potentiometer wire of length 100 cm. The e.m.f of the Leclanche cell is found to balance on 75 cm of the potentiometer wire. The e. m. f. of the cell is

a) 3.5 V b) 2.5 V c) 1.5 V d) 0.5 V

135. For the accurate measurement of resistance by metre bridge, the null point should be obtained

a) Towards left end b) Towards right end
c) At the middle of wire d) All of these

136. The effective resistance between points A and B is

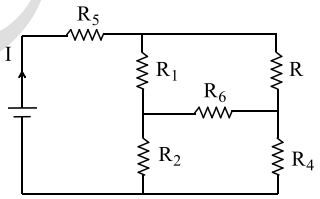


a) 10 Ω
b) 20 Ω
c) 40 Ω
d) None of the above three values

137. V-I graph makes an angle θ with current-axis then the resistance of conductor is given by :

a) Sin θ b) Cos θ c) Tan θ d) Cot θ

138. In the given circuit, it is observed that the current I is independent of the value of the resistance R_6. Then the resistance values must satisfy

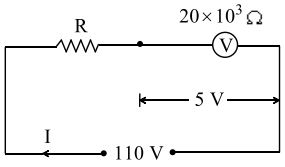


a) $R_1R_2R_5 = R_3R_4R_6$
b) $\frac{1}{R_5} + \frac{1}{R_6} = \frac{1}{R_1 + R_2} + \frac{1}{R_3 + R_4}$
c) $R_1R_4 = R_2R_3$
d) $R_1R_3 = R_2R_4 = R_5R_6$

139. In Seebeck series, antimony appears before bismuth. But in Sb-Bi thermocouple, the current flows from

a) Bi to Sb through hot junction
b) Bi to Sb through cold junction
c) Sb to Bi through hot junction
d) None of these

140. A 100 V voltmeter of internal resistance 20 kΩ in series with a high resistance R is connected to a 110 V line. The voltmeter reads 5 V, the value of R is



a) 210 kΩ b) 315 kΩ c) 420 kΩ d) 440 kΩ

141. Thermo emf produced in a thermocouple depends on the difference in
a) Resistance of the element
b) Length of elements
c) Temperatures of the junctions
d) Sizes of the junction

142. In a potentiometer experiment of a cell of e.m.f. 1.25 V given balancing length of 30 cm. If the cell is replaced by another cell, balancing length of 30 cm. If the cell is replaced by another cell, balancing length is found to be 40 cm. What is the emf of second cell?
a) ≃ 1.57 V b) ≃ 1.67 V c) ≃ 1.47 V d) ≃ 1.37 V

143. In a potentiometer of 10 wires, the balance point is obtained of 6th wire. To shift the balance point to 8th wire we should :
a) Increase resistance in the main circuit
b) Decrease resistance in the main circuit
c) Increase resistance in series with the cell
d) Decrease resistance in series with the cell

144. In a potentiometer experiment, the galvanometer shows no deflection when a cell is connected across 60 cm of the potentiometer wire. If the cell is shunted by a resistance of 6 Ω, the balance is obtained across 50 cm of the wire. The internal resistance of the cell is
a) 0.5 Ω b) 0.6 Ω c) 1.2 Ω d) 1.5 Ω

145. Accuracy with a meter bridge is maximum, when the null point is obtained at the midpoint of the bridge wire. This is because
a) The error due to non uniformity of diameter of the wire is minimum in that case.
b) The error due to the end resistance is minimum.
c) The error due to heating up of wire is minimum.
d) The error due to faulty galvanometer is minimum.

146. A potentiometer circuit has been set up for finding the internal resistance of a given cell. The main battery, used across the potentiometer wire, has an e.m.f. of 2.0 V and a negligible internal resistance. The potentiometer wire itself is 4 m long. When the resistance, R, connected across the given cell, has values of
i. Infinity ii 9.5 Ω
the 'balancing lengths', on the potentiometer wire are found to be 3 m and 2.85 m, respectively. The value of internal resistance of the cell is
a) 0.25 Ω b) 0.95 Ω c) 0.5 Ω d) 0.75 Ω

147. Post office box is an arrangement of finding resistance of a conductor and it makes use of
a) Ampere's law
b) Wheatstones network principle
c) Potentiometer principle
d) Flemings rule

148. Ohm's Law deals with the relation between potential difference and :
a) Charge b) Capacity c) Energy d) Current

149. Balancing length is case of potentiometer can be increased by
a) Decreasing the emf of auxillary battery
b) Decreasing the length of the wire
c) Increasing the emf of auxillary battery
d) Decreasing the external resistance

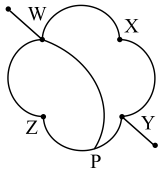
150. Inversion temperature of a thermocouple is that temperature of hot junction at which the e. m. f. is
a) Maximum b) Minimum
c) Zero d) None of these

151. The production of emf by maintaining a difference of temperature between the two junctions of two different metals is known as
a) Joule effect b) Seebeck effect
c) Peltier effect d) Thomson effect

152. A thermocouple is made from copper and iron. At hot junction current
a) Flows from copper towards iron
b) Flows from iron towards copper
c) Flow decreases
d) Flow increases

153. Kirchhoff's second law is based on the law of conservation of
a) Charge b) Energy
c) Momentum d) Current

154. In the given mesh WXYZW, each wire is uniform wire of resistance r Ω. If a wire of resistance 1 Ω is connected across WP and a constant potential difference is applied across WY, points X and P will be equipotential. Then point P on YZ placed such that



a) $PZ/YP = \sqrt{2}$ b) $YP/PZ = \sqrt{2}$
c) $PY/PZ = \sqrt{2}$ d) $(PZ/YP)^{\frac{1}{2}} = 1/\sqrt{2}$

155. A 2.0 V potentiometer is used to determine the

internal resistance of a 1.5 V cell. The balance point of the cell in open circuit is 75 cm. When a resistor of 10 Ω is connected across the cell, the balance point shifts to 60 cm. The internal resistance of the cell is

a) 1.5 Ω b) 2.5 Ω c) 3.5 Ω d) 4.5 Ω

156. In a potentiometer, potential difference across the potentiometer wire is directly proportional to its

a) Length b) Area
c) Resistance d) All of these

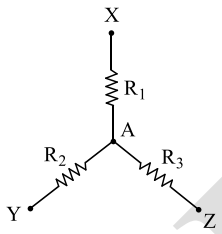
157. A potentiometer is an ideal instrument for measuring potential difference or e. m. f. because

a) It has a long wire
b) It uses a sensitive galvanometer
c) It does not disturb the potential difference it measures
d) Both 'a' and 'b'

158. Potential gradient is defined as fall of potential per unit :

a) Length of wire b) Area of wire
c) Volume of wire d) Temperature of wire

159. A section XYZ of a circuit is as shown in figure. If electric levels at points X, Y and Z are V_1, V_2 and V_3 respectively, then the potential at point A is



a) $\left[\frac{V_1}{R_1}+\frac{V_2}{R_2}+\frac{V_3}{R_3}\right][R_1+R_2+R_3]^{-1}$

b) $\left[\frac{V_1}{R_1}+\frac{V_2}{R_2}+\frac{V_3}{R_3}\right][R_1+R_2+R_3]$

c) $\left[\frac{V_1}{R_1}+\frac{V_2}{R_2}+\frac{V_3}{R_3}\right]\left[\frac{1}{R_1}+\frac{1}{R_2}+\frac{1}{R_3}\right]^{-1}$

d) $\left[\frac{V_1}{R_1}+\frac{V_2}{R_2}+\frac{V_3}{R_3}\right]\left[\frac{1}{R_1}+\frac{1}{R_2}+\frac{1}{R_3}\right]$

160. Kirchhoff's law are used to calculate the current in

a) Simple circuits b) Complicated circuits
c) Parallel circuit d) None of these

161. A thermocouple can be used to measure rapidly changing temperature because it has

a) Zero thermal capacity
b) Small thermal capacity
c) Large thermal capacity
d) Infinite thermal capacity

162. An external resistance R is connected to a cell of internal resistance r. The power in the circuit is maximum when ?

a) $R > r$ b) $R < r$
c) $R = r$ d) Cannot be predicted

163. In Wheatstone's bridge, three resistors P, Q, R are connected in three in order and 4^{th} arm S is formed by two resistors S_1 and S_2 connected in parallel. The condition for bridge to be balanced is $\frac{P}{Q} =$

a) $\frac{R(S_1+S_2)}{S_1S_2}$ b) $\frac{S_1S_2}{R(S_1+S_2)}$
c) $\frac{RS_1S_2}{(S_1+S_2)}$ d) $\frac{(S_1+S_2)}{RS_1S_2}$

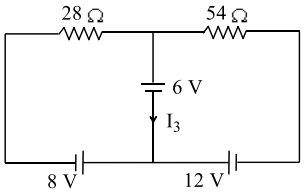
164. In potentiometer experiment, when the galvanometer shows no deflection, then no current flows in

a) Potentiometer wire b) Galvanometer circuit
c) Main circuit d) Battery

165. Thermo electric power is the rate of change of thermo emf with

a) Temperature
b) Time
c) Distance
d) Thermo electric current

166. Consider the circuit shown in the figure. The current I_3 is equal to



a) 5 ampere b) 3 ampere
c) -3 ampere d) $-5/6$ ampere

167. Slide wire bridge does not operate on the same principle as the

a) Wheatstone bridge b) Potentiometer
c) Post office box d) Metrebridge

168. Thermocouple is an arrangement of two different metals to convert

a) Heat energy in to electrical energy
b) Electrical energy into chemical energy
c) Electrical energy into heat energy
d) Heat energy into chemical energy

169. The internal resistance of an ideal cell is

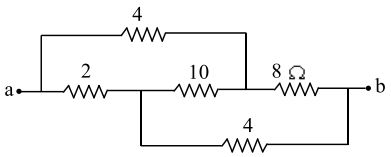
a) Zero b) 1 ohm c) 2 ohm d) Infinity

170. In the determination of internal resistance of cell by potentiometer, the value of shunt

resistance across the cell is increased then balancing length :

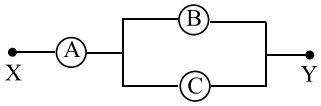
a) Remains unchanged b) Decreases
c) Increases d) Fluctuate

171. The equivalent resistance between the points a and b in the given circuit is



a) 2 Ω b) 4 Ω c) 8 Ω d) 16 Ω

172. A, B and C are voltmeters of resistance R, 1.5R, and 3R respectively as shown in the figure. When some potential difference is applied between X and Y, the voltmeter readings are V_A, V_B and V_C respectively, then

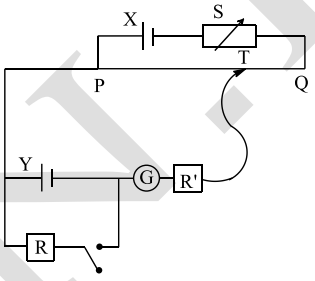


a) $V_A = V_B = V_C$ b) $V_A \neq V_B = V_C$
c) $V_A = V_B \neq V_C$ d) $V_A = V_B \neq V_C$

173. An accumulator of 4 V is connected through a resistance of 30 Ω to a potentiometer wire 10 m long and of resistance 30 Ω. When a cell is connected through a galvanometer to the potentiometer the null point is found at 5.5 m from the common terminal. The potential gradient in the wire is

a) $\frac{1}{15}$V/m b) $\frac{1}{10}$V/m c) $\frac{1}{5}$V/m d) $\frac{1}{3}$V/m

174. Figure shows a potentiometer circuit for measuring the internal resistance r of a cell Y. When the cell is an open circuit, T is the balance point on the wire PQ. The resistor R' is used



a) To make the galvanometer G more sensitive
b) To produce a long balance length
c) Because G is sensitive galvanometer
d) To protect the potentiometer wire

175. In a thermocouple, minimum current flows at the :

a) Neutral temperature
b) Inversion temperature
c) The temperature between neutral and inversion temperature
d) Twice the inversion temperature

176. A thermocouple cannot be preferred to use as thermometer above this temperature

a) Cold junction temperature
b) Hot junction temperature
c) Inversion temperature
d) Neutral temperature

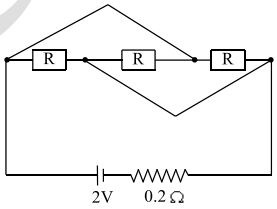
177. At which point will the null point be obtained on a metrebidge if the ratio of the resistances in the two gaps is 2:3?

a) 25 cm b) 30 cm c) 40 cm d) 60 cm

178. In the measurement of a resistance by the Wheatstone bridge, the known and the unknown resistance are interchanged to eliminate

a) Minor error
b) Observational error
c) Error due to thermoelectric effect
d) Connection error

179. Three equal resistors, R Ω each are connected as shown in the figure. The value of R for which heat generated in the circuit is maximum is



a) 0.1 Ω b) 0.2 Ω c) 0.4 Ω d) 0.6 Ω

180. For a thermocouple , the temperature of inversion is that temperature at which thermo emf is

a) Zero b) Maximum
c) Minium d) None of the above

181. A potentiometer wire of length 1 m and resistance 10 Ω is connected in series with a cell of e.m.f. 2 V with internal resistance 1 Ω and a resistance box including a resistance R. If potential difference between the ends of the wire is 1 mV, the value of R is

a) 20000 Ω b) 19989 Ω c) 10000 Ω d) 9989 Ω

182. In Cu-Fe couple, the flow of current at the temperature of inversion is

a) From Fe to Cu through the hot junction
b) From Cu to Fe through the hot junction
c) Maximum
d) None of the above

183. S. I. unit of conductance is

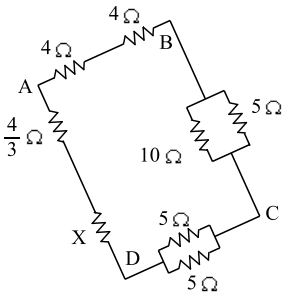
a) Ohm b) Mho

c) Siemen d) Both 'b' and 'c'

184. When the potential difference applied across a solid conductor is increased, the rate of flow of electrons
a) Decreases
b) Increases
c) Remains same
d) Decreases sharply

185. Sign conventions used to apply Kirchhoff's current law are
a) Entering and leaving currents are positive
b) Entering and leaving currents are negative
c) Entering currents are positive and leaving currents are negative
d) All of these

186. In the adjoining figure, the potential drop between B and D is zero. The value of X is



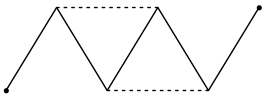
a) $\frac{7}{2}\Omega$ b) $\frac{14}{3}\Omega$ c) 5 Ω d) $\frac{17}{3}\Omega$

187. A cell has an emf of 3 volt and internal resistance 2 Ω. It is connected to an ammeter having resistance 2 Ω and to an external resistance of 100 Ω. When a voltmeter is connected across the 100 Ω resistance, the ammeter reading is 40 mA. The resistance of the voltmeter is
a) 49 Ω b) 98 Ω c) 147 Ω d) 245 Ω

188. A potentiometer wire has length 4 m and resistance 8 Ω. The resistance that must be connected in series with the wire and an accumulator of e.m.f. 2 V, so as to get a potential gradient 1 mV per cm on the wire is
a) 32 Ω b) 40 Ω c) 44 Ω d) 48 Ω

189. A metrebridge cannot be used to determine
a) Resistance of a wire b) Specific resistance
c) Conductivity d) e. m. f. of a cell

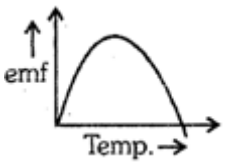
190. Five identical resistors each of resistance 1 Ω are initially arranged as shown in the figure by dark lines. If two similar resistances are added as shown by the dashed lines, then change in resistance in final and initial arrangement is

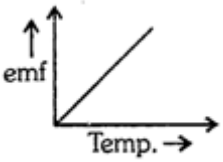


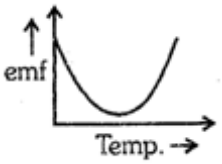
a) 1 Ω b) 2 Ω c) 3 Ω d) 4 Ω

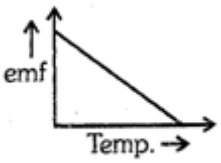
191. Antimony and bismuth are usually used in a thermocouple, because
a) Negative thermal emf produced
b) Constant thermal emf produced
c) Lower thermal emf produced
d) Higher thermal emf produced

192. Which of the following graph represent the variation of emf with temperature of hot junction, if temperature of cold junction is 0°C ? :

a) 

b) 

c) 

d) 

193. Charge carriers in the thermocouple are
a) Electron b) Protons c) +ve ions d) -ve ions

194. A uniform wire of 16 Ω is made into the form of a square. Two opposite corners of the square are connected by a wire of resistance 16 Ω. The effective resistance between the other two opposite corners is
a) 32 Ω b) 20 Ω c) 8 Ω d) 4 Ω

195. If the length and area of cross section of a conductor are doubled, its resistance will be
a) Halved b) Unchanged
c) Doubled d) None of these

196. Two ends of a conductor are at different temperatures the electromotive force generated between two ends is
a) Seebeck electro motive force (emf)
b) Peltier electro motive force (emf)
c) Thomson electro mative force (emf)
d) None of these

197. In a thermocouple , the temperature that does not depend on the temperature of the cold junction is called
a) Neutral temperature
b) Temperature of inversion
c) Both the above

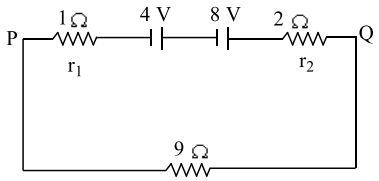
d) None of the above

198. The reciprocal of resistance is

a) Resistivity b) Conductance

c) Capacitance d) Inductance

199. Two batteries of e. m. f. 4 V and 8 V with internal resistances 1 Ω and 2 Ω are connected in a circuit with a resistance of 9 Ω as shown in figure. The current and potential difference between the points P and Q are respectively



a) $\frac{1}{3}$ A and 3 V b) $\frac{1}{6}$ A and 4 V

c) $\frac{1}{9}$ A and 9 V d) $\frac{1}{2}$ A and 12 V

200. In comparing e. m. f. of two cells by a potentiometer, balance point is obtained on 5th wire, the current flowing through the wire is taken

a) From both cells

b) From the battery of main circuit

c) From one of these cell

d) None of the battery or cell

N.B.Navale

Date : 28.03.2025
Time : 03:00:00
Marks : 200

TEST ID: 55
PHYSICS

4.CURRENT ELECTRICITY,9.CURRENT ELECTRICITY

: ANSWER KEY :

1)	b	2)	c	3)	a	4)	c	105)	a	106)	d	107)	c	108)	c
5)	c	6)	b	7)	a	8)	c	109)	a	110)	a	111)	a	112)	b
9)	c	10)	d	11)	b	12)	c	113)	a	114)	b	115)	c	116)	a
13)	b	14)	d	15)	c	16)	b	117)	c	118)	b	119)	d	120)	a
17)	b	18)	d	19)	d	20)	d	121)	a	122)	a	123)	a	124)	b
21)	b	22)	c	23)	d	24)	a	125)	d	126)	b	127)	a	128)	c
25)	a	26)	d	27)	d	28)	c	129)	c	130)	d	131)	d	132)	a
29)	d	30)	c	31)	b	32)	c	133)	c	134)	c	135)	c	136)	a
33)	b	34)	c	35)	a	36)	d	137)	c	138)	c	139)	a	140)	c
37)	c	38)	d	39)	a	40)	a	141)	c	142)	b	143)	a	144)	c
41)	a	42)	c	43)	a	44)	d	145)	b	146)	c	147)	b	148)	d
45)	d	46)	a	47)	a	48)	d	149)	a	150)	c	151)	b	152)	a
49)	d	50)	b	51)	a	52)	b	153)	b	154)	b	155)	b	156)	a
53)	c	54)	b	55)	c	56)	a	157)	c	158)	a	159)	c	160)	b
57)	a	58)	b	59)	b	60)	a	161)	b	162)	c	163)	a	164)	b
61)	a	62)	a	63)	a	64)	a	165)	a	166)	d	167)	b	168)	a
65)	b	66)	b	67)	b	68)	c	169)	a	170)	c	171)	b	172)	a
69)	a	70)	a	71)	d	72)	b	173)	c	174)	c	175)	b	176)	d
73)	b	74)	d	75)	a	76)	a	177)	c	178)	c	179)	d	180)	a
77)	b	78)	a	79)	c	80)	d	181)	b	182)	a	183)	d	184)	b
81)	d	82)	c	83)	d	84)	b	185)	c	186)	b	187)	d	188)	a
85)	c	86)	d	87)	d	88)	d	189)	d	190)	b	191)	d	192)	a
89)	d	90)	a	91)	c	92)	b	193)	a	194)	d	195)	b	196)	c
93)	b	94)	b	95)	b	96)	b	197)	a	198)	b	199)	a	200)	b
97)	a	98)	b	99)	a	100)	a								
101)	a	102)	b	103)	a	104)	d								

N.B.Navale

Date : 28.03.2025 **TEST ID: 55**
Time : 03:00:00 **PHYSICS**
Marks : 200

4.CURRENT ELECTRICITY,9.CURRENT ELECTRICITY

: HINTS AND SOLUTIONS :

Single Correct Answer Type

1 **(b)**

$I = \frac{2}{R + 10}$

$\therefore V = I R_{AB} = \frac{2}{R + 10} \times 10 = \frac{20}{R + 10}$

$\therefore \frac{V}{L} = \frac{20}{(R + 10)1} = \frac{20}{R + 10}$

$\therefore E_1 = l\left(\frac{V}{L}\right)$

$\therefore 10 \times 10^{-3} = 0.4\left(\frac{20}{R + 10}\right)$

$\therefore R + 10 = \frac{8}{10^{-2}} = 800 \Rightarrow R = 790\ \Omega$

3 **(a)**

$\frac{V}{L} = 10\ V/m$

$\therefore V = 10 \times L = 10 \times 25 \times 10^{-2} = 2.5\ V$

4 **(c)**

Manganin or constantan are used for making the potentiometer wire

5 **(c)**

As the bridge is balanced,

$\frac{R_{AB}}{R_{BC}} = \frac{R_{AD}}{R_{DC}}$

$\therefore \frac{15 + 6}{(X||8) + 3} = \frac{15 + (6||6)}{4 + (4||4)}$

$\therefore \frac{21}{\left(\frac{8X}{8+X}\right) + 3} = \frac{18}{4 + 2}$

$\therefore 168 + 21\,X = 33X + 72$

$\therefore 12X = 96 \Rightarrow X = \frac{96}{12} = 8\Omega$

6 **(b)**

$F = qE \Rightarrow E\frac{F}{q} = \frac{V}{L}$

$\therefore V = \frac{FL}{q} = \frac{2.4 \times 10^{-19} \times 6}{1.6 \times 10^{-19}} \Rightarrow V = 9\ V$

$\therefore$ e. m. f. of cell= $V = 9\ V$

9 **(c)**

At a junction,

Current entering = Current leaving

$\therefore I + 4 + 2 = 5 + 3 \Rightarrow I = 2\ A$

10 **(d)**

The bridge is balanced.

The balance condition after replacing 10 Ω resistor by 20 Ω resistor will remain the same

$\therefore R_{eq.} = 4\Omega||28\Omega = \frac{4 \times 28}{4 + 28} = \frac{4 \times 28}{32} = \frac{7}{2}\Omega$

11 **(b)**

$\frac{X}{R} = \frac{l_x}{l_R}$

$\frac{20}{30} = \frac{l_x}{l_R}$

$\Rightarrow \frac{l_x}{l_R} = \frac{40}{60}$, as

For meterbridge, $l_x + l_R = 100$ cm

$\Rightarrow l_x = 40$ cm

After reducing resistance,

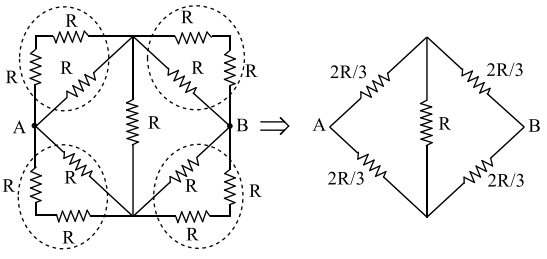
$\frac{X'}{R} = \frac{l'_x}{100 - l'_x}$

$\therefore \frac{10}{30} = \frac{l'_x}{100 - l'_x}$

$\therefore l'_x = 25$ cm

The distance through which balance point is shifted $l_x - l'_x = 40 - 25 = 15$ cm to the left

15 **(c)**



As the bridge is balanced,

$\therefore R_{eq} = \frac{2R}{3}$

18 **(d)**

EMF of Cell,

$E = kl'$

$E = \frac{E'}{l} \times l'$

$E = \frac{E'}{10} \times 250$ ...(i)

After increasing the length by 1m,

$E = \frac{E'}{11} \times x$

Substituting for E from equation (i)

$$\frac{E'}{10}\times 250=\frac{E'}{11}\times x$$

$$\therefore x=\frac{250\times 11}{10}=275\text{ cm}=2.75\text{ m}$$

20 **(d)**

$$\frac{E_1}{E_2}=\frac{l_1+l_2}{l_1-l_2}=\frac{(6+2)}{(6-2)}=\frac{2}{1}$$

23 **(d)**

For the balance condition,

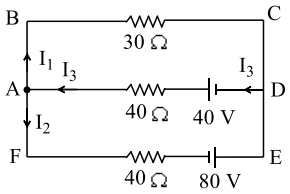
$\frac{P}{Q}=\frac{R}{S||X}$ where X is the resistance with which S is shunted,

$$\therefore \frac{2}{2}=\frac{2}{\left(\frac{3\times X}{3+X}\right)}$$

$$\therefore 3X=6+2X\Rightarrow X=6\Omega$$

31 **(b)**

The circuit can be simplified as follows:



Applying Kirchhoff's current law to junction A,

$$I_3=I_1+I_2 \quad ...(i)$$

Applying Kirchhoff's voltage law for the loop ABCDA,

$$-30I_1+40-40I_3=0$$

$$\therefore -30I_1-40(I_1+I_2)+40=0 \quad ...[\text{From (i)}]$$

$$\therefore 7I_1+4I_2=4 \quad ...(ii)$$

Applying Kirchhoff's voltage law for the loop ADEFA,

$$-40I_2+80+40-40I_3=0$$

$$\therefore -40I_2-40(I_1+I_2)=-120 \quad ...[\text{From (i)}]$$

$$\therefore I_1+2I_2=3$$

On applying equations (ii) and (iii),

$$I_1=-0.4\text{ A}$$

32 **(c)**

$$\text{Potential gradient }(x)=\frac{I\rho}{A}=\frac{0.1\times 10^{-7}}{10^{-6}}=10^{-2}\text{V/m}$$

36 **(d)**

$$\frac{X}{1}=\frac{20}{80}\Rightarrow X=\frac{1}{4}\Omega=0.25\ \Omega$$

40 **(a)**

According to Kirchhoff's voltage law, the correct equation is $\varepsilon_1-(i_1+i_2)R-i_1r_1=0$

42 **(c)**

For first case, the balancing condition is

$$\frac{10+R_1}{R_2}=\frac{50}{50}$$

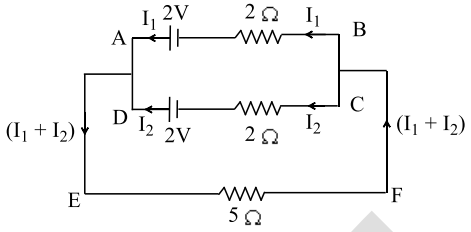
$$\therefore R_2=10+R_1$$

For second case, the balancing condition is

$$\frac{R_1}{R_2}=\frac{40}{60}$$

$$\frac{R_1}{10+R_1}=\frac{2}{3}\Rightarrow R_1=20\ \Omega$$

44 **(d)**



Applying Kirchhoff's second law for closed loop AEFBA we get,

$$-(I_1+I_2)\times 5-I_1\times 2+2=0 \text{ or}$$

$$7I_1+5I_2=2 \quad ...(i)$$

Again, applying Kirchhoff's second law for a closed loop DEFCD we get,

$$-(I_1+I_2)\times 5-I_2\times 2+2=0$$

$$\text{Or } 5I_1+7I_2=2 \quad ...(ii)$$

Multiplying (i) by 5 and (ii) by 7 we get,

$$35I_1+25I_2=10 \quad ...(iii)$$

$$35I_1+49I_2=14 \quad ...(iv)$$

Subtracting (iv) from (iii) we get,

$$-24I_2=-4\Rightarrow I_2=\frac{1}{6}\text{A}$$

Subtracting the value of I_2 in equation (i) we get,

$$7I_1=2-5\times\frac{1}{6}\Rightarrow 7I_1=\frac{7}{6}\Rightarrow I_1=\frac{1}{6}\text{A}$$

The current through the 5Ω

$$=I_1+I_2=\frac{1}{6}\text{A}+\frac{1}{6}\text{A}=\frac{1}{3}\text{A}$$

45 **(d)**

$$\text{Potential gradient}=\frac{I\rho}{A}$$

$$=\frac{10^{-2}\times 10^{-3}\times 10^{9}\times 10^{-2}}{10^{-2}\times 10^{-4}}$$

$$=\frac{10^2}{10^{-6}}=10^8\text{V/m}$$

48 **(d)**

$$R_{AB}=2\times 10=20\ \Omega$$

$$\therefore I=\frac{3}{10+20}=\frac{3}{30}=\frac{1}{10}$$

$$\therefore V=I\,R_{AB}=\frac{1}{10}\times 20=2\text{ V}$$

$$\therefore \frac{V}{L}=\frac{2}{10}=0.2\text{ V/m}$$

50 **(b)**

1^{st} case: $\frac{R_1}{X}=\frac{2}{3}$ ...(i)

2^{nd} case: $\frac{R_2}{X}=\frac{3}{2}$ ...(ii)

Adding equations (i) and (ii),

$$\frac{R_1}{X}+\frac{R_2}{X}=\frac{2}{3}+\frac{3}{2}$$

$$\frac{R_1 + R_2}{X} = \frac{13}{6}$$

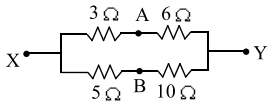
Let l be the distance of null point from left

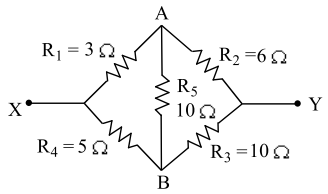
$$\frac{l}{100 - l} = \frac{13}{6}$$

$\therefore 6l = 1300 - 13\,l$

$\therefore 19\,l = 1300 \Rightarrow l = \frac{1300}{19} = 68.4$ cm from left

52 **(b)**





$\because \frac{R_1}{R_4} = \frac{R_2}{R_3}$

Wheatstone's bridge network is balanced. Hence there is no current flowing through AB (through R_5)

$\therefore$ The given circuit is equivalent to

$R_{xy} = (3 + 6)||(5 + 10)$

$\therefore R_{xy} = \frac{9 \times 15}{15 + 9} = \frac{9 \times 15}{24} = \frac{45}{8}\Omega$

54 **(b)**

$l_1 = 52 + 1 = 53$ cm, $l_2 = 48 + 2 = 50$ cm

As the bridge is balanced,

$$\frac{l_1}{l_2} = \frac{X}{R} = \frac{53}{50} = \frac{X}{10}$$

$\Rightarrow X = 10.6\ \Omega$

55 **(c)**

$\frac{l_P}{l_Q} = \frac{P}{Q} = \frac{1}{3} \Rightarrow 3P = Q$

$\therefore 3P - Q = 0$ ...(i)

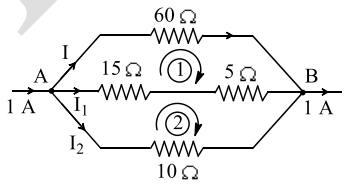
$$\frac{P + 40}{Q + 40} = \frac{3}{5}$$

$\therefore 5P + 200 = 3Q + 120$

$\therefore 5P - 3Q = -80$ ...(ii)

Solving equations (i) and (ii) we have, $P = 20\ \Omega, Q = 60\ \Omega$

62 **(a)**



Applying Kirchhoff's law

At junction A:

$i + i_1 + i_2 = 1$ ...(i)

For loop (1)

$-60i + (15 + 5)i_1 = 0$

$\therefore i_1 = 3i$ ...(ii)

For loop (2)

$-(15 + 5)i_1 + 10\,i_2 = 0$

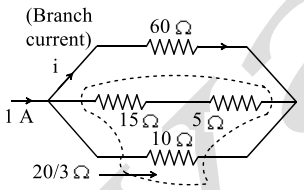
$\therefore i_2 = i_1 = (3\,i) = 6i$ ...(iii)

On solving equations (i), (ii) and (iii) we get $i = 0.1$ A

Alternate Method:

Branch current = Main current $\times \left(\frac{\text{Resistance of opposite branch}}{\text{Total resistance}}\right)$

$$\Rightarrow i = 1 \times \left[\frac{\frac{20}{3}}{\frac{20}{3} + 60}\right] = 0.1\ \text{A}$$



63 **(a)**

For T_1 $R_1 = \frac{V}{I_1}; R_2 = \frac{V}{I_2}$

$I_1 \propto I_2\ ; R_1 > R_2\ ; T_1 > T_2$

64 **(a)**

$\sigma = T\frac{d^2E}{dT^2} = T\frac{d}{dt}\left(\frac{dE}{dT}\right) = T\frac{d}{dt}(s) = T\frac{dS}{dT}$

66 **(b)**

When null point is obtained on potentiometer wire, the cell whose potential difference is to be measured does not supply current to potentiometer wire since galvanometer deflection is zero. Therefore current through the potentiometer wire is due to auxillary battery

67 **(b)**

The given network is a balanced Wheatstone bridge. It's equivalent resistance will be

$R = \frac{18}{5}\Omega$

$\therefore i = \frac{V}{R} = \frac{V}{18/5} = \frac{5V}{18}$

69 **(a)**

Appling Kirchhoff's law,

$(2 + 2) = (0.1 + 0.3 + 0.2)I$

$\therefore I = \frac{20}{3}A$

$\therefore$ Potential difference across A

$= 2 - 0.1 \times \frac{20}{3} = \frac{4}{3}$V (less than 2V)

Potential difference across B

$= 2 - 0.3 \times \frac{20}{3} = 0$

72 **(b)**

The variation of thermo emf with temperature of hot junction follows parabolic path. It means that e.m.f. will first increase then decrease and finally reversed. 78. The variation of thermo emf with temperature of hot junction in a thermocouple is represented by a parabolic curve.

80 **(d)**

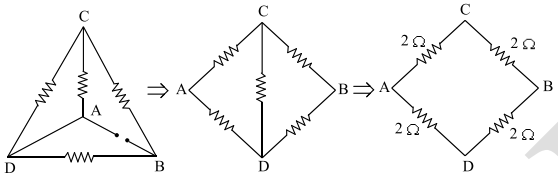
No change because, potential gradient does not depends upon diameter of wire.

83 **(d)**

When current is passed through a thermocouple, the heat is evolved or absorbed at a junction according to Pelter effect.

87 **(d)**

The equivalent circuits are as shown below



The circuit is a balanced Wheatstone's bridge.

Hence effective resistance between A and B

$= 4\ \Omega || 4\ \Omega = 2\ \Omega$

90 **(a)**

$I = \frac{E}{R + r} = \frac{2}{8 + 2} = 0.2A$

$\therefore V = IR = 0.2 \times 8 = 1.6$ V

$\therefore$ Potential gradient $= \frac{V}{L} = \frac{1.6}{4} = 0.4$ V/m

94 **(b)**

$I = \frac{E}{R + r_2} = \frac{5}{40 + 10} = \frac{5}{50} = 0.1A$

95 **(b)**

Current from D to C = 1 A

$\therefore V_D - V_C = 2 \times 1 = 2$ V

$V_A = 0 \Rightarrow V_C = 1$ V,

$\therefore V_D - V_C = 2$

$\therefore V_D - 1 = 2 \Rightarrow V_D = 3$ V

$\therefore V_D - V_B = 2$

$\Rightarrow 3 - V_B = 2 \Rightarrow V_B = 1$ V

96 **(b)**

This is balanced Wheatstone's bridge circuit. Hence potentials at B and D will be same and no current flows through the resistance 4R

98 **(b)**

Initially, $\frac{5}{l_1} = \frac{R}{100 - l_1}$ ...(i)

Finally, $\frac{5}{1.6 l_1} = \frac{R/2}{(100 - 1.6 l_1)}$ ...(ii)

$\therefore \frac{R}{1.6(100 - l_1)} = \frac{R}{2(100 - 1.6 l_1)}$

$\therefore 100 - 1.6\ l_1 = 200 - 3.2\ l_1$

$\therefore 1.6\ l_1 = 40$

$\therefore l_1 = 25$

From equation (i),

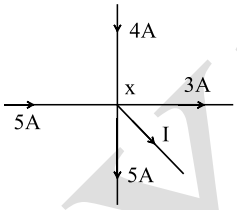
$\frac{5}{25} = \frac{R}{75} \Rightarrow R = 15\ \Omega$

102 **(b)**

According to Kirchhoff's voltage law,

$(+5) + (+4) + (-3) + (-5) + I = 0$

$\therefore I = -1$ A



[−ve sign shows that current is flowing away from x.]

104 **(d)**

$R \propto \ell\ k \propto \frac{1}{R}; k \propto \frac{1}{\ell}$

105 **(a)**

$I = \frac{E}{R + r} = \frac{2}{990 + 10} = \frac{2}{1000}$A

$\therefore V = IR = \frac{2}{1000} \times 10$

$\therefore$ Potential gradient $= \frac{V}{L} = \frac{2}{100} \times \frac{1}{2} = 0.01$ V/m

108 **(c)**

Below neutral temperature, thermo e. m. f. increases and above neutral temperature, thermo e. m. f. decreases.

109 **(a)**

Four resistances forming a Wheatstone's network are 8 Ω, 12 Ω, 6 Ω and 27 Ω. After shunting the 27 Ω resistance with say, S, the balance condition will be,

$\frac{8}{12} = \frac{6}{\left(\frac{27S}{27+S}\right)} \Rightarrow \frac{1}{3} = \frac{3(27 + S)}{27S}$

$\therefore 27\ S = 243 + 9\ S \Rightarrow 13.5\ \Omega$

110 **(a)**

$r = \left(\frac{l_1 - l_2}{l_2}\right) R$

$\therefore R = \left(\frac{25}{100}\right) 2 = 0.5\ \Omega$

112 **(b)**

Potentiometer is said to be more sensitive if it

gives large change in the balancing length for a small change in p. d. (i.e., $\frac{dE}{dl}$ should be small)

$E = \frac{V}{L} \times l$

$\therefore \frac{dE}{dl} = \frac{V}{L} \Rightarrow \frac{V}{L}$ be small

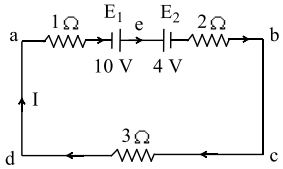
116 **(a)**

Potential difference per unit length,

$\frac{V}{L} = \frac{2}{4} = 0.5$ V/m

119 **(d)**

Since $E_1(10\text{ V}) > E_2(4\text{ V})$, hence current in the circuit will be clockwise

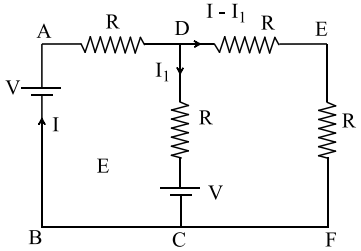


Applying Kirchhoff's voltage law,

$-1 \times I + 10 - 4 - 2 \times I - 3I = 0$

$\therefore I = 1A$ (a to b via e)

121 **(a)**



For loop ABCDA,

$IR + I_1R + V - V = 0$

$\therefore (I + I_1)R = 0 \Rightarrow I_1 = -I$

Now, In loop ABFEA,

$IR + (I - I_1)R + (I - I_1)R - V = 0$

$\therefore IR + IR - I_1R + IR - I_1R = V$

$\therefore 3IR - 2I_1R = V$

$\therefore 3IR - 2(-I)R = V$

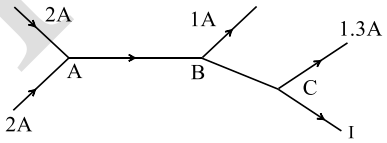
$\therefore 5IR = V \Rightarrow I = \frac{V}{5R}$

122 **(a)**

According to Kirchhoff's first law,

At junction A, $I_A = 2 + 2 = 4$ A

At junction B, $I_B = I_{BC} + 1 = 4$ A $\Rightarrow I_{BC} = 3$A



At junction C, $I = I_{BC} - 1.3 = 3 - 1.3 = 1.7$ A

123 **(a)**

Let E_A, E_B and E_C be the e.m.f. of three cells A, B and C respectively

For the given potentionmetre,

$E_A + E_B + E_C = kl_1 = k \times 740$ ...(i)

$E_A + E_B = kl_2 = k \times 440$ ...(ii)

$E_B + E_C = kl_3 = k \times 540$ ...(iii)

From eq. (i) and (ii), we get

$E_C = 300k$

From equations (i) and (iii) we get,

$E_A = 200k$

Substituting value of E_A into equation (ii) we get,

$\therefore E_B = 240k$

$\therefore E_A : E_B : E_C = 200k : 240k : 300k$

$= 10 : 12 : 15 = 1 : 1.2 : 1.5$

$\therefore E_A = 1V, E_B = 1.2$ V, $E_V = 1.5$ V

130 **(d)**

Zero (No Potential difference across voltmeter)

134 **(c)**

P.D. across potentiometer wire $= 2$ V

Potential gradient $= \frac{V}{L} = \frac{2}{100}$V/cm

Now, $E = \left(\frac{V}{L}\right) l$

$\therefore E = \frac{2}{100} \times 75 = 2 \times \frac{3}{4} = 1.5$ V

136 **(a)**

This is balanced Wheatstone bridge circuit. Hence no current will flow from the diagonal resistance 10 Ω

$\therefore$ Equivalent resistance $= \frac{(10+10)\times(10+10)}{(10+10)+(10+10)}$

$= 10\ \Omega$

138 **(c)**

As I is independent of R_6, no current flows through R_6. This implies that the junction of R_1 and R_2 is at the same potential as the junction of R_3 and R_4. This must satisfy the condition $\frac{R_1}{R_2} = \frac{R_3}{R_4}$, as in the Wheatstone's bridge

139 **(a)**

For given difference in temperature of two junctions of a thermocouple, the thermo e. m. f. is more if the separation between two metals in the Seebeck series used in the formation of thermocouple Sb and Bi are extreme metals of the series.

140 **(c)**

$I = \frac{110}{20\times10^3+R}$ ...(i)

Now, $V = IR$

$\therefore 5 = \left(\frac{110}{20\times10^3+R}\right) \times 20 \times 10^3$ ...[From (i)]

$\therefore 10^5 + 5R = 22 \times 10^5$

$\therefore R = 21 \times \frac{10^5}{5}$

$= 420\ k\Omega$

142 **(b)**

$E_1 \propto L_1$ and $E_1 \propto L_2$

$\therefore \frac{E_1}{E_2} = \frac{L_1}{L_2} \Rightarrow \frac{1.25}{E_2} = \frac{30}{40} \Rightarrow E_2 = \frac{5}{3} \approx 1.67$ V

143 **(a)**

$E_1 = p.g \times \ell \quad p.g. = \frac{IR}{L}$

To shift null point from 6^{th} to 8^{th} wire i. e. ℓ should constant to satisfy this p. g. should be decreased i. e resistance in main circuit should be increased.

144 **(c)**

$r = \frac{(l_1 - l_2)}{l_2} \times R' = \left(\frac{60-50}{50}\right) \times 6 = 1.2\ \Omega$

145 **(b)**

When null-point is close to one end, the resistance, which cannot be ignored. This leads to error in measurement. When null point is at the centre, resistance of wire is greater than contact resistance, Further both the parts of wire have relatively same proportion of contact resistance.

146 **(c)**

$r = \left(\frac{l_1}{l_2} - 1\right) R = \left(\frac{3}{2.85} - 1\right) 9.5\ \Omega$

$= \frac{0.15}{2.85} \times 9.5\Omega = 0.5\ \Omega$

152 **(a)**

In the iron-copper thermocouple, the current flows from copper to iron through hot junction if the temp. of hot and cold junctions are below the neutral temperature.

155 **(b)**

$r = R\left(\frac{l}{l_1} - 1\right) = 10\left(\frac{75}{60} - 1\right)$

$= 10\left(\frac{15}{60}\right) = 2.5\ \Omega$

163 **(a)**

For balancing the bridge

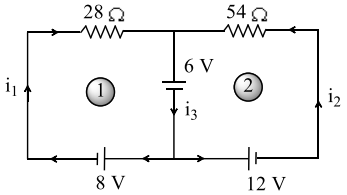
$\frac{P}{Q} = \frac{R}{S}$

$\therefore S = \frac{S_1 S_2}{S_1 + S_2}$ ... ($\because S_1, S_2$ are in parallel)

$\therefore \frac{P}{Q} = \frac{R(S_1 + S_2)}{S_1 S_2}$

166 **(d)**

Suppose current through different paths of the circuit is as follows:



Applying Kirchhoff's voltage law to loop (1) and loop (2) we get,

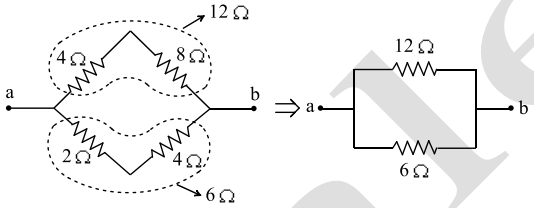
$28i_1 = -6 - 8 \Rightarrow i_1 = -\frac{1}{2}$ A and

$54i_2 = -6 - 12 \Rightarrow i_2 = -\frac{1}{3}$ A

$\therefore i_3 = i_1 + i_2 = -\frac{5}{6}$ A

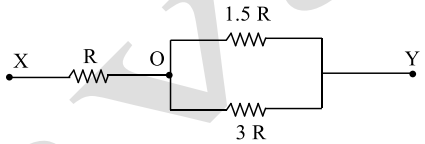
171 **(b)**

Given circuit is a balanced Wheatstone bridge circuit. Hence it can be redrawn as follows:



$\therefore R_{AB} = \frac{12 \times 6}{(12+6)} = 4\ \Omega$

172 **(a)**



$R_{OY} = \frac{1.5R \times 3R}{(1.5+3)R} = R$

$R_{XO} = R_{OY} = R$

$\Rightarrow V_{XO} = V_{OY}$

$\Rightarrow V_A = V_B = V_C$

173 **(c)**

$I = \frac{E}{R+r} = \frac{4}{30+30} = \frac{1}{15}$ A

$\therefore V = I \times R = \frac{1}{15} \times 30 = 2$V

$\Rightarrow K = \frac{2}{10} = \frac{1}{5}$ V/m

174 **(c)**

G is a sensitive galvanometer and to protect it from damage of heavy currents, some resistance R' is introduced

177 **(c)**

$\frac{X}{100 - X} = \frac{2}{3}$

$\therefore 3X = 200 - 2X$

$\therefore 5X = 200 \Rightarrow X = 40$ cm

181 **(b)**

$V = I.R = \frac{e}{(R + R_h + r)} R$

$\therefore 10^{-3} = \frac{2}{(10 + R + 1)} \times 10$

$\therefore R = 19{,}989\ \Omega$

186 **(b)**

As the bridge is balanced,

$$\frac{R_{AB}}{R_{AD}} = \frac{R_{BC}}{R_{CD}}$$

$$\therefore \frac{4+4}{\left(\frac{4}{3}+X\right)} = \frac{10||5}{5||5}$$

$$\therefore \frac{8}{\left(\frac{4}{3}+X\right)} = \frac{50/15}{25/10}$$

$$\therefore \frac{8}{\left(\frac{4}{3}+X\right)} = \frac{50}{15}\times\frac{10}{25} = \frac{4}{3}$$

$$\therefore \frac{4}{3}+X = 6 \Rightarrow X = 6-\frac{4}{3} = \frac{14}{3}\Omega$$

188 **(a)**

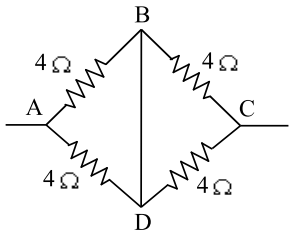
P.D. across the wire = Potential gradient × length

$V_0 = 1\text{mV/cm} \times 400\text{ cm} = 0.4\text{V}$

Current in the wire, $I = \frac{0.4}{8} = 0.05$ A

$$R = \frac{V-V_0}{I} = \frac{2-0.4}{0.05} = 32\ \Omega$$

194 **(d)**



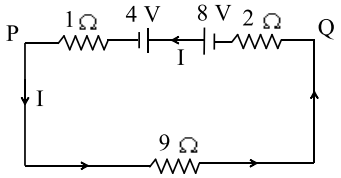
According to the principle of Wheatstone's bridge, the effective resistance between the given point is

$= (4+4)\Omega||(4+4)\Omega$

$= 8\Omega||8\Omega = 4\Omega$

199 **(a)**

Applying Kirchhoff's voltage law to the given loop QPQ,



$$-2I + 8 - 4 - 1\times I - 9I = 0 \Rightarrow I = \frac{1}{3}\text{A}$$

$\therefore$ Potential difference across PQ $= \frac{1}{3}\times 9 = 3$ V