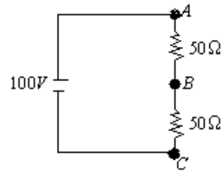
CURRENT ELECTRICITY

1. **In the circuit shown below, a voltmeter of internal resistance R, when connected across B and C reads 100/3 volts. Neglecting the internal resistance of the battery, the value of R is:**

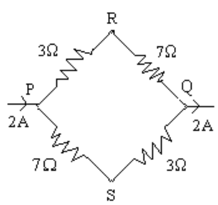


1) $100k\Omega$ 2) $75k\Omega$ 3) $50k\Omega$ 4) $25k\Omega$

2. **A cell in secondary circuit gives null deflection for 2.5 m length of potentiometer having 10m length of wire. If the length of the potentiometer wire is increased by 1m without changing the cell in the primary, the position of the null point now is:**

1) 3.5m 2) 3m 3) 2.75m 4) 2.0m

3. **A current of 2 A flows in an electric circuit as shown in figure. The potential difference** $(V_R - V_S)m$ **in volts (V_R and V_S are potentials at R and S respectively) is**



1) – 4 (2) + 2 (3) + 4 (4) – 2

4. **When a battery connected across a resistor of 16Ω, the voltage across the resistor is 12 V. When the same battery is connected across a resistor of 10Ω, voltage across it is 11 V. The internal resistance of the battery in Ohms is**

(1) $\frac{10}{7}$ (2) $\frac{20}{7}$ (3) $\frac{25}{7}$ (4) $\frac{30}{7}$

5. **Two unknown resistance X and Y are connected to left and right gaps of a meter bridge and the balancing point is obtained at 80 cm from left. When a 10Ω resistance is connected in parallel to X, the balancing point is 50 cm from left. The values of X and Y respectively are**

(1) 40Ω, 9Ω (2) 30Ω, 7.5Ω (3) 20Ω, 6Ω (4) 10 Ω, 3Ω

6. **The current in a circuit containing a battery connected to 2Ω resistance is 0.9 A. When a resistance of 7Ω connected to the same battery, the current observed in the circuit is 0.3A. Then the internal resistance of the battery is**

(1) 0.1 Ω (2) 0.5 Ω (3) 1 Ω (4) Zero

7. **One end each of a resistance 'r' capacitance C and resistance '2r' are connected together. The other ends are respectively connected to the positive terminals of the batteries P, Q, R having respectively e.m.f s E, E and 2E. The negative terminals of the batteries are then connected together. In this circuit, with steady current the potential drop across the capacitance is:**

1) $\frac{E}{3}$ 2) $\frac{E}{2}$ 3) $\frac{2E}{3}$ 4) E

8. **Twelve cells, each having e.m.f 'E' volts are connected in series and are kept in a closed box. Some of these cells are wrongly connected with positive and negative terminals reversed. This 12 cell battery is connected in series with an ammeter, an external resistance 'R' ohms and a two-cell battery (two cells of the same type used earlier, connected perfectly in series). The current in the circuit when the 12-cell battery and 2-cell battery aid each other. Then the number of cells in 12-cells battery that are connected wrongly is**

1) 4 2) 3 3) 2 4) 1

9. **A 6V cell with $0.5\,\Omega$ internal resistance, a 10V cell with $1\,\Omega$ internal resistance and a $12\,\Omega$ external resistance are connected in parallel. The current (in amperes) through the 10V cell is**

1) 0.60 2) 2.27 3) 2.87 4) 5.14

10. **In a meter bridge a resistance is connected in the left gap and a pair of resistances P and Q in the right gap. Measured from the left, the balance point is 37.5 cm when P and Q are in series and 71.4 cm when they are parallel. The values of P and Q (in) are**

1) 40; 10 2) 35; 15 3) 30; 20 4) 25; 25

11. **'n' conducting wires of same dimensions but having resistivities 1, 2, 3,...n are connected in series. The equivalent resistivity of the combination is**

1) $\frac{n(n+1)}{2}$ 2) $\frac{n+1}{2}$ 3) $\frac{n+1}{2n}$ 4) $\frac{2n}{n+1}$

12. **Two cells A and B are connected in the secondary circuit of a potentiometer one at a time and the balancing length are respectively 400cm and 440 cm. The e.m.f. of the cell A is 1.08 volt. The e.m.f. of the second cell B in volts is**

1) 1.08 2) 1.188 3) 11.88 4) 12.8

13. **In a potentiometer experiment, the balancing length with a cell is 560 cm. When an external resistance of 10 ohm is connected in parallel to the cell the balancing length changes by 60cm. The internal resistance of the cell in ohms is**

1) 3.6 2) 2.4 3) 1.2 4) 0.6

14. **Two resistances of 400Ω and 800Ω are connected in series with 6 volt battery of negligible internal resistance. A voltmeter of resistance 10,000 Ω is used to measure the potential difference across 400Ω. The error in the measurement of potential difference in volt approximately is**

1) 0.01 2) 0.02 3) 0.03 4) 0.05

15. **The balancing length for a cell is 560 cm in a potentiometer experiment. When an external resistance of 10 is connected in parallel to the cell the balancing length changes by 60 cm. The internal resistance of the cell in ohms is**

1) 1.6 2) 1.4 3) 1.2 4) 0.12

16. **A conductor of resistance 3 ohm is stretched uniformly till its length is doubled. The wire now is bent in the form of an equilateral triangle. The effective resistance between the ends of any side of the triangle in ohms is**

1) $\frac{9}{2}$ 2) $\frac{8}{3}$ 3) 2 4) 1

17. **A uniform conductor of resistance R is cut into 20 equal pieces. Half of them are joined in series and the remaining halves of them are connected in parallel. If the two combinations are joined in series, the effective resistance of all the pieces is**

1) R 2) $\frac{R}{2}$ 3) $\frac{101R}{200}$ 4) $\frac{201R}{200}$

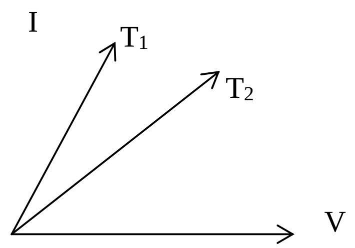
18. **Two wires of equal diameters, of resistivities ρ_1, ρ_2 and lengths x_1 and x_2 respectively are joined in series. The equivalent resistivity of the combination is**

1) $\frac{\rho_1 x_1 + \rho_2 x_2}{x_1 + x_2}$ 2) $\frac{\rho_1 x_2 - \rho_2 x_1}{x_1 - x_2}$ 3) $\frac{\rho_1 x_2 + \rho_2 x_1}{x_1 + x_2}$ 4) $\frac{\rho_1 x_1 - \rho_2 x_2}{x_1 - x_2}$

19.. **A flash light lamp is marked 3.5V and 0.28A. The filament temperature is 425^0C. The filament resistance of 0^0C is 4Ω. Then, the temperature coefficient of resistance of the material of the filament is:**

1) $8.5\times10^{-3}/K$ 2) $3.5\times10^{-3}/K$ 3) $0.5\times10^{-3}/K$ 4) $5\times10^{-3}/K$

20. **I and V are respectively the current and voltage in a metal wire of resistance 'R'. Two I-V graphs at two different temperatures T_1 and T_2 are given in the graph. Then**



(1) $T_1 = T_2$ (2) $T_1 > T_2$ (3) $T_1 < T_2$ (4) $T_1 = 2T_2$

21. **A projector lamp can be used at a maximum voltage of 60 V, its resistance is 20Ω, the series resistance (in ohms) required to operate the lamp from a 75 V supply is**

(1) 2 (2) 3 (3) 4 (4) 5

22. **A teacher asked a student to connect 'N' cells each of e.m.f. 'e' in series to get a total e.m.f. of Ne. While connecting, the student, by mistake, reversed the polarity of 'n' cells. The total e.m.f. of the resulting series combination is :**

1) $e\left(N - \frac{n}{2}\right)$ 2) $e(N-n)$ 3) $e(N-2n)$ 4) eN

23. **Two wires A and B, made of same material and having their lengths in the ratio 6 : 1 are connected in series. The potential differences across the wires are 3V and 2V respectively. If r_A *and* r_B radii of A and B respectively then $\frac{r_B}{r_A}$ is:**

1) $\frac{1}{4}$ 2) $\frac{1}{2}$ 3) 1 4) 2

24. **For a chosen non-zero value of voltage, there can be more than one value of current in:**

1) Copper wire 2) Thermistor 3) Zener diode 4) Manganine wire

25. **The temperature coefficient resistivity of a material is 0.0004/K. When the temperature of the material is increased by 50° C, its resistivity increases by 2×10^{-8} ohm-meter. The initial resistivity of the material in ohm-meter is**

1) 50×10^{-8} 2) 90×10^{-8} 3) 100×10^{-8} 4) 200×10^{-8}

26. **Two cells with the same EMF 'E" and different internal resistances r_1 and r_2 are connected in series to an external resistance R. The value of R so that the potential difference across the first cell be zero is**

1) $\sqrt{r_1 r_2}$ 2) r_1+r_2 3) $r_1 - r_2$ 3) $\frac{r_1+r_2}{2}$

27. Three unequal resistors in parallel are equivalent to a resistance 1 ohm. If two of them are in the ratio 1: 2 and if no resistance value is fractional, the largest of the three resistances in ohms is

1) 4 2) 6 3) 8 4) 12

28. In potentiometer experiment a cell of emf. 1.5 V connected in the secondary circuit gives a balancing length of 165cm of the wire. If a resistance of 5 is connected parallel to the cell, the balancing length of the wire is 150cm. The internal resistance of the cell is

1) 5 2) 1.5 3) 1 4) 0.5

29. The sides of a rectangular block are 2cm, 3cm and 4cm. The ratio of the maximum to minimum resistance between its parallel faces is

1) 4 2) 3 3) 2 4) 1

30. Three equal resistances each of 3 are in series and connected to a cell of internal resistance one ohm. If these resistances are in parallel and connected to the same cell, then the ratio of the respective currents through the electric circuits in the two cases is

1) $\frac{1}{8}$ 2) $\frac{1}{7}$ 3) $\frac{1}{5}$ 4) $\frac{1}{3}$

31. An ideal battery of emf 2V and a series resistance R are connected in the primary circuit of a potentiometer of length 1m and resistance 5Ω. The value of R to give a potential difference of 5mV across the 10cm of potentiometer wire is

1) 180Ω 2) 190Ω 3) 195Ω 4) 200Ω

32. A nichrome wire 50cm long and one square millimeter cross-section carries a current of 4A when connected to a 2V battery. The resistivity of nichrome wire in ohm-meter is

1) 1×10^{-6} 2) 4×10^{-7} 3) 3×10^{-7} 4) 2×10^{-7}

33. When a resistor of 11Ω is connected in series with an electric cell, the current flowing in it is 0.5A. Instead when a resistor of 5Ω is connected to the same electric cell in series the current increases by 0.4A. The internal resistance of the cell is

1) 1.5 2) 2 3) 2.5 4) 3.5

34. Four resistances 10, 5, 7 and 3 are connected so that they form the sides of a rectangle AB, BC, CD and DA respectively. Another resistance of 10 is connected across the diagonal AC. The equivalent resistance between A and B is

1) 2 2) 5 3) 7 4) 10

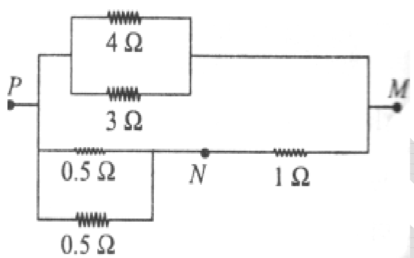
35. **In a meter bridge experiment, the ratio of the left gap resistance to right gap resistance is 2:3, the balance point from left is**

1) 60 cm 2) 50 cm 3) 40 cm 4) 20 cm

36. **An aluminium** $\left[\rho = 2.2\times10^{-8}\Omega m\right]$ **wire of a diameter 1.4 mm is used to make a** 4Ω **resistor. The length of the wire is**

1) 220m 2) 1000m 3) 280m 4) 1m

37. **In the circuit shown, the current through the** 4Ω **resistor is 1 amp when the points P and M are connected to a d.c. voltage source. The potential difference between the points M and N is**



1) 0.5 volt 2) 3.2 volt 3) 1.5 volt 4) 1.0 volt

38. **A wire of a certain material is stretched slowly by ten percent. Its new resistance and specific resistance become respectively**

1) Both remain the same 2) 1.1 times, 1.1 times

3) 1.2 times, 1.1 times 4) 1.21 times, same

39. **A cell can be balanced against 110cm and 100cm of potentiometer wire, respectively with and without being short circuited through a resistance of** $10\,\Omega$ **. Its internal resistance is**

1) 2.0 ohm 2) zero 3) 1.0 ohm 4) 0.5 ohm

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

1) $\varepsilon_2 - i_2 r_2 - \varepsilon_1 - i_1 r_1 = 0$ 2) $-\varepsilon_2 - (i_1 + i_2)R + i_2 r_2 = 0$

3) $\varepsilon_1 - (i_1 + i_2)R + i_1 r_1 = 0$ 4) $\varepsilon_1 - (i_1 + i_2)R - i_1 r_1 = 0$

41. **A wire of resistance 12 ohms per meter is bent to form a complete circle of radius 10cm. The resistance between its two diametrically opposite points A and B as shown in the figure is**

1) 3Ω 2) $6\pi\Omega$ 3) 6Ω 4) $0.6\pi\Omega$

42. **A student measures the terminal potential difference (V) of a cell (of emf ε and internal resistance r) as a function of the current (I) flowing through it. The slope, and intercept, of the graph between V and I, then, respectively, equal**

1) –r and ε 2) r and $-\varepsilon$ 3) $-\varepsilon$ and r 4) ε and –r

43. **The mean free path of electrons in a metal is 4 x 10^{-8} m. The electric field which can give on an average 2 eV energy to an electron in the metal will be in units V/m**

1) 5 x 10^{-11} 2) 8 x 10^{-11} 3) 5 x 10^{7} 4) 8 x 10^{-7}

44. **The important difference between manganin and nichrome is**

1) Manganine is a metal and Nichrome is a non- metal

2) Temperature coefficient of resistance α is high for manganin and low for nichrome

3)α is low for manganin and high for nichrome

4) Nichrome is an alloy and manganuin is an element

45. **The electric current passing through a metallic wire produces heat because**

1) collision conduction electrons with each other

2) collision of atoms of the metal with each other

3) the energy released in the ionization of the atoms of the metal

4) collision of conduction electrons with the atoms of the metallic wire

46. **The number of electrons crossing per sec. Any section of a conductor carrying a current of 3.2 amp and normal to the direction of flow is**

1) 3×10^{19} 2) 3.2×10^{19} 3) 10^{19} 4) 2×10^{19}

47. **A metallic block has no potential difference applied across it. Then the mean velocity of a free electron is**

1) Proportional to T 2) proportional to $\sqrt{T}$

3) zero 4) finite but independent of temperature

48. **A steady current is passing through a linear conductor of non-uniform cross-section. The net quantity of charge passing any cross-section per second is**

1) more at larger area of cross-section

2) same at any cross-section

3) more at smaller area of cross-section

4) none of these

49. **At absolute zero silver wire behaves as**

1) Super conductor 2) semiconductor 3) perfect insulator 4) semi insulator

50. **Potentiometer wire is made of manganin because it has**

1) high conductivity
2) negligible melting point

3) high temperature coefficient of resistance

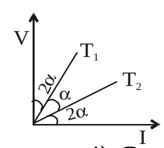
4) negligibly small temperature coefficient of resistance

51. **Thermistor is**

1) Semi conductor 2) insulator 3) conductor 4) none

52. **The figure shows the variation of**

V with I at temperatures T_1 and T_2
$(T_1 – T_2)$ is proportional to



1) Tan2θ 2) Tanθ 3) Sinθ 4) Cos2θ

53. **A thermistor is a semi conductor whose electric resistance**

1) is independent of temperature
2) increases with temperature

3) decreases with temperature
4) first increases and then decreases

54. **A copper wire is stretched to increase its length by 0.2%. The percentage of increase in its resistance is**

1) 0.2 2) 0.4 3) 0.04 4) 0.02

55. **Two wires of equal diameters and of resistivities ρ_1 and ρ_2 and lengths x_1 and x_2 respectively are joined in series. The equivalent resistivity of the combination is**

1) $\frac{\rho_1 x_1 + \rho_2 x_2}{x_1 + x_2}$ 2) $\frac{\rho_1 x_2 - \rho_2 x_1}{x_1 - x_2}$ 3) $\frac{\rho_1 x_2 + \rho_2 x_1}{x_1 + x_2}$ 4) $\frac{\rho_1 x_1 - \rho_2 x_2}{x_1 - x_2}$

56. **A certain piece of copper is to be shaped into a conductor of minimum resistance. Its length and diameter should be respectively**

1) L, D   2) 2L, D   3) L, 2D   4) 2L,D/2

57. **When current flows through a conductor, its temperature**

1) Increases   2) decreases   3) remains same   4) none

58. **Two resistances R_1 and R_2 are made of different materials. The temperature coefficient of resistance of material R_1 is α and that of material R_2 is-β. The resistance of the series combination of R_1 and R_2 will not change with temperature if R_1/R_2 is equal to**

1) α/β 2) $(\alpha+\beta)(\alpha-\beta)$ 3) $(\alpha^2+\beta^2)/2\alpha\beta$ 4) β/α

59. **Aluminium ($\alpha = 4 \times 10^{-3} K^{-1}$) resistance of 60$\Omega$ and carbon ($\alpha = -0.5 \times 10^{-3} K^{-1}$) resistance of 40$\Omega$ are connected in parallel. The combination is heated. The effective resistance**

1) Greater than 24Ω   2) Less than 24 Ω

3) Greater than 40 Ω   4) Greater than 100Ω

60. **Constantan wire is used for making standard resistance because it has**

1) low specific resistance   2)high specific resistance

3) negligible temperature coefficient of resistance 4)high melting point

61. **The heating element in an electric iron is made of**

1) nichrome   2) iron   3) constantan   4) tungsten

62. **The internal resistance of a battery does not depend on**

1) The sizes of the electrodes
2) The distance between then

3) The external resistance in the circuit
4) The strength of the electrolyte

63. **Two cells, each of e.m.f. ε and internal resistance r, are connected in parallel across a resistor R. The power delivered to the resistor is maximum if R is equal to**

1) r/2   2) r   3) 2r   4) 0

64. **n cells of each e.m.f 'E' and internal resistancer are connected to an external resistance R in series. But one cell is connected in reverse polarity. Then the current i will be obtained by the formula**

1) $i = \frac{(n-2)E}{nR+r}$ 2) $i = \frac{(n-2)E}{R+(n-2)r}$ 3) $i = \frac{(n-2)E}{R+nr}$ 4) $i= \frac{(n-1)E}{R=(n-1)r}$

65. **In a closed circuit, the e.m.f and internal resistance of the generator are ε and r respectively. If the external resistance in the circuit is R, the Ohm's law has the form**

1) $I = \varepsilon/(R+r)$ 2) $I = \varepsilon/R$ 3) $I = \varepsilon/r$ 4) $I = \varepsilon/Rr$

66. **A cell of e.m.f. ε is connected across a resistance r. The potential difference between the terminals of the cell is found to be V. The internal resistance of the cell must be**

1) $\frac{2(\varepsilon - V)V}{r}$ 2) $\frac{2(\varepsilon - V)r}{\varepsilon}$ 3) $\frac{(\varepsilon - V)\ r}{V}$ 4) $(\varepsilon - V)\ r$

67. **If six identical cells each having an e.m.f. of 6V are connected in parallel, the e.m.f. of the combination is**

1) 1V 2) 36V 3) 1/6V 4) 6V

68. **If n resistors each of 10 ohm resistance are first connected in parallel and then in series, the ratio of resultant resistances will be**

1) n: 1 2) n^2: 1 3) 1: 1 4) 1: n^2

69. **When three resistors of resistances 3, 4, 5Ω are connected in parallel, the current through them are in the ratio**

1) 3:4:5 2) 5:4:3 3) 20:15:12 4) 12:15:20

70. **The equivalent resistance of resistors in series is always**

1) equal to the mean of the component resistors

2) less than the lowest of the component resistors

3) in between the lowest and the highest of the component resistors

4) equal to the sum of the component resistors

71. **If a copper wire is stretched so that its length increases by 0.2%. Then its resistance**

1) increases by 0.2% 2) increases by 0.4%

3) decreases by 0.2% 4) decreases by 0.4%

72. **A 10 m long potentiometer wire with resistance 2 ohm per metre is connected to an accumulator. On doubling the radius of the wire, keeping its length same, the value of potential gradient will become**

1) half 2) double 3) one fourth 4) unchanged

73. **Back emf of a cell is due to**

1) Electrolytic polarization 2) peltier effect

3) magnetic effect of current 4) none

74. **In gases the charge carriers are**

1) Electrons 2) ions 3) proton 4) neutron

75. **Kirchoffs second law is based on the law of conservation of**

1) charge 2) energy

3) momentum 4) sum of mass and energy

76. **The purpose of high resistance in meter bridge circuit is**

1) To get accurate balance point

2) To save the current

3) To protect the galvanometer from damage

4) To change the direction of current

77. **The purpose of commutator in potentiometer experiment is**

1) To protect the meter from the damage

2) To control the strength of the current

3) To reverse the current through out the circuit

4) To change the direction of current passing through the galvanometer

78. **The Wheatstone bridge is most sensitive when the arm ratio is**

1) Equal to one 2) ten 3) greater than one 4) less than one

79. **The four resistances P, Q, R and S of a wheat stone's bridge are 4, 0, 20 and 200 Ω** respectively. To balance the bridge

1) $\frac{200}{3}$ Ω to be connected in parallel to 200 Ω

2) $\frac{200}{3}$ Ω to be connected in series to 200 Ω

3) 4 Ω to be connected in series to 20 Ω

4) $\frac{10}{3}$ Ω to be connected in series with 10 Ω

80. **A series high resistance is preferable to a shunt resistance in the galvanometer circuit of potentiometer, because**

1) Shunt resistance are costly 2) Shunt resistance damage the meter

3) The series resistance reduces the current through the meter in an unbalanced potentiometer

4) High resistance are easily available

81. The α and ρ of the potentiometer wire must be

1) high and low 2) low and high 3) low and low 4) high and high

82. A potentiometer is superior to voltmeter for measuring a potential because

1) Voltmeter has high resistance
2) Resistance of potentiometer wire is quite low
3) Potentiommeter dose not draw any current from the unknown source of e.m.f. to be measured
4) Sensitivity of potentiometer is higher than that of a voltmeter

83. The potential gradient is defined as

1) fall of potential per unit length of the wire
2) fall of potential per unit area of the wire
3) fall of potential between two ends of the wire
4)potential at any end of the wire

84. In a potentiometer experiment, at null point, current does not flow in the

1) Galvanometer circuit 2) potentiometer wire
3) Primary circuit 4) cell

85. If the e.m.f of a source in the primary circuit of the potentiometer is increased three times, then the value of the potential gradient will be

1) 9 times 2) 6 times 3) 3 times 4) $\sqrt{3}$ times

86. The sensitiveness of a potentiometer can be increased by

1) decreasing the length of its wire
2) increasing the e.m.f. of the battery in the primary circuit
3) decreasing the potential gradient on its wire
4)increasing the potential gradient on its wire

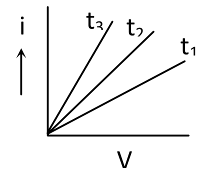
87. In a potentiometer of ten wires, the balance point is obtained on the sixth wire. To shift the balance point to eighth wire, we should

1) increase resistance in the primary circuit 2) decrease resistance in the primary circuit
3)decrease resistance in series with the cell whose e.m.f. has to be measured
4) increase resistance in series with the cell whose e.m.f has to be measured

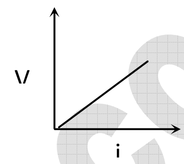
88. **i-v graph for a metal at temperatures t_1, t_2, t_3 are as shown. Then highest temperature is**

1) t_1 2) t_2

3) t_3 4) All are equal



89. **The variation of current (i) with potential difference (V) for a metallic conductor is shown in the graph. The slope of the graph will be more if**



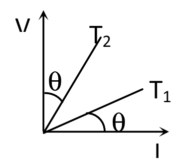
1) wire of half length is used

2) wire of double the area of cross section is used

3) the experiment is performenced at higher temperature

4) the resistance of the wire is 4Ω

90. **The V-I graph for a conductor at temperature T_1 and T_2 are as shown in the figure. Then $(T_2 – T_1)$ is proportional to**



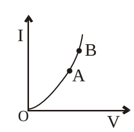
1) $\cos 2\theta$ 2) $\sin 2\theta$

3) $\cot 2\theta$ 4) $\tan 2\theta$

91. **A curve is shown in the figure. This is graph between V and I. This curve belongs to**

1) resistance obeying ohm's law 2) diode

3) heated carbon resistance bulb 4) thyristor



92. **A series high resistance is preferable to a shunt resistance in the galvanometer circuit of potentiometer, because**

1) shunt resistance are costly

2) shunt resistance damage the meter

3) the series resistance reduces the current through the meter in an unbalanced potentiometer

4) high resistance are easily available

93. **If the radius of a potentiometer wire is increases four times, keeping its length constant then the value of its potential gradient will become**

1) half 2) two times 3) four times 4) constant

94. **Metal wire is connected in the left gap, semiconductor is connected in the right gap of Meter Bridge and balancing point is found. Both are heated so that changes of resistances in them are same. Then the balancing point**

1) will not shift 2) shifts towards left

3) shifts towards right   4) depends on rise of temperatures

95. **In meter bridge experiment, the known and unknown resistances in the two gaps are interchanged. The error so removed is**

1) end correction   2) index error

3) due to temperature effect   4) random error

96. **Choose the correct statement in the following**

A: Thermister is a heat sensitive and ohmic device.

B: Thermister can be used as a thermostat.

1) A only true   2) B only true

3) Both A and B are true   4) Both A and B are false

97. **Match the following:**

List - I	**List – II**
a) Potentiometer	**e) For measuring current**
b) Meter bridge	**f) For measuring internal resistance**
c) Ammeter	**g) For measuring specific resistance of wire**
d) Voltmeter	**h) For measuring potential difference**

1) a–f, b–g, c–e, d –h   2) a–g, b–e, c–f, d –h

3) a–h, b–e, c–f, d –g   4) a–h, b–f, c–e, d –g

98. **Match the following:**

List – I	**List – II**
a) Thermister	**e) High positive 'α'**
b) Carbon	**f) α almost zero**
c) Nichrome	**g) Either positive is negative 'α'**
d) Constantan, manganin	**h) Negative 'α'**

1) a–g, b–h, c–e, d –f   2) a–h, b–g, c–e, d –f

3) a–e, b–f, c–g, d –h   4) a–e, b–g, c–h, d –f

99. Match the following:

List – I	**List – II**
a) Charging cell	**e) V = O**
b) Discharging cell	**f) V = E**
c) Cell short circuited	**g) V < E**
d) Cell in open circuit	**f) V > E**

1) a–g, b–h, c–e, d –f
2) a–g, b–e, c–h, d –f
3) a–f, b–g, c–h, d –e
4) a–h, b–g, c–e, d –f

100. Match the following:

List - I

a) Reciprocal of resistance

b) Reciprocal of resistivity

c) Resistance of a wire of unit length and unit cross section

d) Drift velocity per unit electric field

List – II

e) Resistivity

f) Current density per conduction electron charge in unit volume

g) Electric conductance

h) Conductivity

1) a–h, b–g, c–e, d–f
2) a–g, b–h, c–f, d–e
3) a–h, b–g, c–f, d–e
4) a–g, b–h, c–e, d–f

Assertion & Reason: In each of the following questions, a statement is given and a corresponding statement or reason is given just below it. In the statements, mark the correct answer as

1) If both Assertion and Reason are true and Reason is correct explanation of Assertion.
2) If both Assertion and Reason are true but Reason is not the correct explanation of Assertion.
3) If Assertion is true but Reason is false.
4) If Assertion is false but Reason is true.

101. [A]: In a metrebridge copper wire is connected in the left gap and silica is connected in the right gap, when the temperature of both wires increases, balancing point shifts to right.
[R]Temperature coefficient of copper is negative –ve and that of silicon is positive +ve.

102. [A]: In a potentiometer; if emf of primary cell is decreased and length of the wire is increased, its sensitivity increases.

[R]: Sensitivity is more for low potentied gradient.

103. [A]: In any junction of a closed network. Algebraic sum of various currents is zero.
[R]: Current can not be stored. It must flow on.

104. [A]: In a balanced wheatstone's bridge, if galvanometer and battery are interchanged, the balancing condition is not disturbed.
[R]: The balancing condition of a wheatstone bridge goes not depend on resistances.

105. [A]: Junction diodes, transistors are ohmic resistors.
[R]: For a ohmic resistor, voltage current graph is a straight line passing through origin.

106. [A]: Kirchhoff's junction law follows from conservation of charge.
[R]: Kirchhoff's loop law follows from conservative nature of electric field.

107. [A]: Alloys like constantan and nichrome are used for making resistance wires used in resistance boxes where pure metals are used for making connection wires.
[R]: Specific resistance of the alloys like constantan, nichrome is quite high whereas specific resistance of pure metals is low.

108. [A]: External potential difference is more than the e.m.f of a cell when current flows in opposite direction.
[R]: Internal resistance of the cell opposes current in either direction

109. [A]: The temperature coefficient of resistance is always positive.
[R]: On increasing the temperature the resistance of metals and alloys increases.

110. [A]: When the radius of a copper wire is doubled, its specific resistance gets increased.
[R]: Specific resistance is independent of cross-section of material used.

KEY:

1) **3**	2) **3**	3) **3**	4) **2**	5) **2**	6) **2**	7) **1**	8) **1**	9) **3**	10) **3**
11) **1**	12) **2**	13) **3**	14) **4**	15) **3**	16) **2**	17) **3**	18) **1**	19) **4**	20) **3**
21) **4**	22) **3**	23) **2**	24) **3**	25) **3**	26) **3**	27) **2**	28) **4**	29) **1**	30) **3**
31) **3**	32) **1**	33) **3**	34) **2**	35) **3**	36) **3**	37) **2**	38) **4**	39) **3**	40) **4**
41) **4**	42) **1**	43) **3**	44) **3**	45) **1**	46) **4**	47) **1**	48) **2**	49) **1**	50) **3**
51) **1**	52) **2**	53) **3**	54) **2**	55) **1**	56) **3**	57) **1**	58) **4**	59) **2**	60) **3**
61) **1**	62) **3**	63) **1**	64) **3**	65) **1**	66) **3**	67) **4**	68) **4**	69) **3**	70) **4**
71) **2**	72) **4**	73) **1**	74) **2**	75) **2**	76) **3**	77) **4**	78) **1**	79) **1**	80) **3**
81) **2**	82) **3**	83) **1**	84) **1**	85) **3**	86) **3**	87) **1**	88) **1**	89) **3**	90) **3**
91) **3**	92) **3**	93) **4**	94) **3**	95) **1**	96) **2**	97) **1**	98) **1**	99) **4**	100) **4**
101) **3**	102) **1**	103) **1**	104) **3**	105) **4**	106) **2**	107) **1**	108) **2**	109) **4**	110) **4**

SOLUTIONS

1. Ans: 3

Sol: From the given circuit,

$$R_1 : R_2 = 50 : \frac{50R}{50+R} = 1 : \frac{R}{50+R}$$

[since 50 and R are in parallel and series to 50]

$$\therefore V_1 : V_2 = 1 : \frac{R}{50+R}$$

[current is same as they are in series]

$$\Rightarrow V_2 = \left[\frac{\left(\frac{R}{50+R}\right)}{\left(1+\frac{R}{50+R}\right)} \right] 100 = \frac{100}{3}$$

Given $\therefore R = 50k\Omega$

2. Ans: 3

Sol: From the Principle of potentiometer $v \alpha l$

For 10m long potentiometer wire, the balancing length is 2.5 m

For 11m long potentiometer wire, the balancing length is $\frac{11(2.5)}{10} = 2.75m$

3. Ans: 3

Sol: Currrent divides equally and equal to 1A in each arm

Potential across upper part and lower part is same and is equal to 10V

Potential at R is $V_R = 7V$

Potential at S is $V_S = 10 - 7 = 3V$

$\therefore V_R - V_S = 7 - 3 = 4V$

Hence (3) is the correct choice

4. Ans: 2

Sol: Potential V = iR $\Rightarrow i = \frac{E}{R+r}$

$$V = \frac{E}{R+r} R$$

$$12 = \frac{E}{16+r} \times 16 \ldots\ldots\ldots\ldots..(1)$$

$$11 = \frac{E}{10+r} \times 10 \ldots\ldots\ldots\ldots..(2)$$

$r = \frac{20}{7}\Omega$ Dividing (1) & (2)

5. Ans: 2

Sol: From the principle of meter bridge $\frac{P}{Q} = \frac{l}{100-l}$

X = 4Y…………………….. (1)

$$\frac{X10}{(X+10)Y} = \frac{50}{50} = 1$$

$$\frac{X10}{(X+10)} \frac{4}{X} = 1$$

$$40 = X + 10$$

$$X = 30\Omega$$

$$Y = \frac{X}{4} = \frac{30}{4} = 7.5\Omega$$

Hence (2) is the correct choice

6. Ans: 2

Sol: $i_i = \frac{E}{R_1 + r}, i_2 = \frac{E}{R_2 + r}$ since $\mathrm{i} = \frac{\mathrm{E}}{\mathrm{R+r}} = \frac{\mathrm{EMF}}{\mathrm{Total\ resis\tan ce}}$

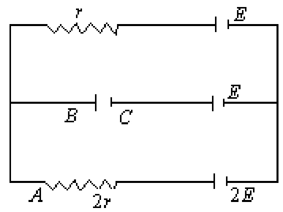
$$\frac{0.9}{0.3} = \frac{\frac{E}{2+r}}{\frac{E}{7+r}} = \frac{7+r}{2+r} \qquad 3 = \frac{7+r}{2+r} \Rightarrow 6 + 3r = 7 + r$$

$$2r = 1 \Rightarrow r = \frac{1}{2} = 0.5\Omega$$

Hence (2) is the correct choice

7. Ans: 1

Sol:



As a capacitor is connected there is no current in second brach, in steady state.

$\therefore$ Current through the outer loop $i = \frac{2E - E}{2r + r} = \frac{E}{3r}$

$\therefore$Potential difference across upper branch $= E + \left(\frac{E}{3r}\right) r = \frac{4E}{3}$

This is also p.d. through middle branch

$\therefore$P.d. across capacitor $= \frac{4E}{3} - E$

$= \frac{E}{3}$

8. Ans: 4

Sol: Let no. of cells be wrongly connected is n

$i_1 = \frac{12E - 2nE + 2E}{R} = 3$ (1)

$i_2 = \frac{12E - 2nE - 2E}{R} = 2$ (2)

Dividing (1) & (2)

$\frac{12 - 2n + 2}{12 - 2n - 2} = \frac{3}{2}$

$\frac{14 - 2n}{10 - 2n} = \frac{3}{2}$

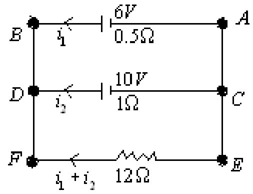
$\frac{7 - n}{5 - n} = \frac{3}{2}$

$14 - 2n = 15 - 3n$

n = 1

9. Ans: 3

Sol:



Potential difference across

AB, CD & EF are same. Applying Kirchoff's Laws

$6-0.5i_1=10-i_2=12(i_1+i_2)$

From above equation $i_2=2.87A$

10. Ans: 3

Sol: If P & Q are in series

$\frac{30}{R_P+R_Q}=\frac{37.5}{62.5}$ ………………….(1)

If P & Q are in parallel

$\frac{30}{\frac{R_PR_Q}{R_P+R_Q}}=\frac{71.4}{28.6}$ ………………….(2)

From (1) & (2)

$R_P=30\Omega$, $R_Q=20\Omega$

11. Ans: 1

Sol: We know that R = $\frac{\rho L}{A}$

When 'n' conducting wires of same dimensions but having resistivities 1, 2, 3……n are connected in series.

R = R_1+R_2 +………R_3

Let is the equivalent resistivity

$$\Rightarrow \frac{\rho L}{A} = \frac{L}{A}(1+2+3+.....n) \Rightarrow \frac{\rho L}{A} = \frac{L}{A} \times \frac{n(n+1)}{2}$$

$\Rightarrow$ Equivalent resistivity $\rho = \frac{n(n+1)}{2}$

12. Ans: 2

Sol: $\frac{E_1}{E_2} = \frac{l_1}{l_2} \Rightarrow E_2 = E_1 \frac{l_2}{l_1} = 1.08 \times \frac{440}{400} = 1.188$

13. Ans: 3

Sol: $r = \frac{R(l_1 - l_2)}{l_2} = \frac{10 \times 60}{500} = 1.2\Omega$

Since $l_1 - l_2 = 60$ and $l_1 = 560$ cm

$\therefore l_2 = 560 - 60$

$\therefore l_2 = 500\ cm$

14. Ans: 4

Sol: The expected voltage drop across 400Ω resistor is

$V = \frac{6 \times 400}{400 + 800} = 2\,volt$

When the volt meter is included in parallel, the combined resistance of 400Ω and 10000Ω is

$\frac{400 \times 10000}{10400} = \frac{40000}{104} = 384.6\Omega$

The voltage drop is $V^1 = \frac{6 \times 384.6}{384.6 + 800} = 1.948$

$\Delta V = V - V^1 = 2 - 1.948 = 0.052V$

15. Ans: 3

Sol: When 10Ω resistance is connected in parallel, the effective resistance to be balanced is $\frac{10r}{10+r}$

$$\frac{l_1}{R_1}=\frac{l_2}{R_2}$$

Since the resistance is connected in parallel,

$R_2 < R_1$ and $l_2 < l_1$. Hence $l_2 = l_1 - 50$

= 560-60

=500 cm

$$\frac{560}{r}=500\frac{(10+r)}{10r}$$

$$\Rightarrow r = 1.2\Omega$$

16. Ans: 2

Sol: $R=\frac{\rho l}{A}=\frac{\rho l^2}{Al}=\frac{\rho l^2}{volume}$ where the volume does not change on stretching

The new resistance

$$R^1=\frac{\rho(2l)^2}{volume}=4R=4\times3=12\Omega$$

Each side will have resistance 4Ω

Two sides in series have resistance 8Ω and the third side of resistance 4Ω is in parallel.

The effective resistance = $\frac{4\times8}{4+8}=\frac{8}{3}\Omega$

17. Ans: 3

Sol: Each part has resistance $\frac{R}{20}$

10 parts in series have total resistance $10\times\frac{R}{20}=\frac{R}{2}$. The remaining 10 parts in parallel have resistance $\frac{1}{10}\times\frac{R}{20}=\frac{R}{200}$.

The resistance of these two combinations in series is $\frac{R}{2}+\frac{R}{200}=\frac{101R}{200}$

18. Ans: 1

Sol: Equivalent resistance of the combination

R = R_1+ R_2 [As they are in series]

$$\frac{\rho\left(x_1+x_2\right)}{\pi r^2}=\frac{\rho_1 x_1}{\pi r^2}+\frac{\rho_2 x_2}{\pi r^2}$$

$$\rho_{eq}=\frac{\rho_1 x_1+\rho_2 x_2}{x_1+x_2}$$

19. Ans: 4

Sol: Given resistance at 425^0C

$$R_2=\frac{V}{i}=\frac{3.5}{0.28}=12.5\Omega$$

Resistance at 0^0C $R_1=4\Omega$

$$\therefore \alpha=\frac{R_2-R_1}{R_1\left(\Delta t\right)} = \frac{12.5-4}{4\left(425\right)}=5\times 10^{-3}/K$$

20. Ans: 3

Sol: V = iR

For given voltage $i\propto\frac{1}{R}$

Resistance increase with increase of temperature and temperature are inversely proportional to voltages.

$\therefore T_1<T_2$

21. Ans:4

Sol: $i=\frac{V}{R}$

For 60V, 20Ω resistance is required

For 75V i.e., extra 15V is required

$$\frac{V_1}{R_1}=\frac{V_2}{R_2}\Rightarrow\frac{60}{20}=\frac{75}{R_2}$$

R_2 = 25

The required additional resistance is 25-20 = 5 Ω

22. Ans: 3

Sol: Total emf = Ne

Present $emf = (N-2n)e$

When n cells reversely connected the emf of 2n cells get cancelled.

23. Ans: 2

Sol: Ratio of potentials $\frac{V_1}{V_2} = \frac{R_1}{R_2} = \frac{l_1 r_B^2}{l_2 r_A^2}$

[As they are connected in series current is same]

$i_A = i_B \therefore R = \frac{Sl}{A} \Rightarrow \frac{R_1}{R_2} = \frac{l_1}{l_2} \times \frac{r_2^2}{r_1^2}$

$\frac{3}{2} = \frac{6}{1}\frac{r_B^2}{r_A^2}$

$\therefore \frac{r_B}{r_A} = \frac{1}{2}$

24. Ans :(3) All semi conductors devices give more than one current value for a given voltage.

25. Ans: 3

Sol: $\rho_2 = \rho_1(1+\alpha\Delta\theta)$ where $\propto$ is the coefficient of resistivity?

$\Rightarrow \rho_1 = \frac{\rho_2 - \rho_1}{\alpha\Delta\theta} = \frac{2\times10^{-8}}{0.0004\times50}$

$= 100\times10^{-8}\,\Omega - m$

26. Ans: 3

Sol: $i = \frac{2E}{R+r_1+r_2} = \frac{Total\ E.M.F.}{Total\ resis\tan ce}$

$V_1 = E - ir_1 = E - \frac{2Er_1}{R+r_1+r_2}$

$= \frac{E(R+r_2-r_1)}{(R+r_1+r_2)} = 0$ [Since p.d. across first cell = 0]

$\Rightarrow R + r_2 - r_1 = 0 \qquad \Rightarrow R = r_1 - r_2$

27. Ans: 2

Sol: $\frac{1}{R} = \frac{1}{R_1} + \frac{1}{2R_3} + \frac{1}{R_3}$

$\Rightarrow \frac{1}{R} = \frac{1}{R_1} + \frac{3}{2R_3}$

$\Rightarrow 1 - \frac{3}{2-R_3} = \frac{1}{R_1} \Rightarrow R_1 = \frac{2R_3}{2R_3 - 3}$

If $R_3 = 3$ then $R_1 = 2\Omega$

$\therefore R_1 = 2\Omega$

$R_2 = 6\Omega$

$R_3 = 3\Omega$

$\therefore$ Largest resistance = 6Ω

28. An s: 4

Sol: $\frac{l_1}{R_1} = \frac{l_2}{R_2}$

If r is the internal resistance of the cell,

$R_2 = \frac{5r}{5+r} \Rightarrow \frac{165}{r} = \frac{150(5+r)}{5r}$

$\Rightarrow r = 0.5\Omega$

29. Ans: 1

Sol: $R = \frac{\rho l}{A}$ The dimensions of the block are $2 \times 3 \times 4$

$R_{max} = \frac{\rho l_{max}}{A_{min}} = \frac{\rho \times 4}{2 \times 3} = \frac{2\rho}{3}$

$R_{min} = \frac{\rho l_{min}}{A_{max}} = \frac{\rho \times 2}{3 \times 4} = \frac{\rho}{6}$

$\frac{R_{max}}{R_{min}} = 4$

30. Ans: 3

Sol: In the series arrangement, $R_1 = (3\times3)+1 = 10\Omega$

$$i_1 = \frac{V}{R_1} = \frac{V}{10} \qquad (1)$$

In the parallel arrangement, $\frac{1}{R} = \frac{1}{3}+\frac{1}{3}+\frac{1}{3} = 1$

$\Rightarrow R = 1\Omega$, $R_2 = 1+1 = 2\Omega$

$$i_2 = \frac{V}{R_2} = \frac{V}{2} \qquad (2)$$

Dividing (1) & (2) $\frac{i_1}{i_2} = \frac{1}{5}$

31. **Ans**: 3

Sol: Voltage drop across the potentiometer wire is

$$V = 5\times10^{-3}\times\frac{100}{10} = 0.05V$$

Current, $i = \frac{V}{R+5} = \frac{2}{R+5}$ Where R = Series Resistance

V = iR, where R' = resistance of potentiometer wire

$$0.05 = \frac{2}{R+5}\times5$$

$\Rightarrow R = 195\Omega$

32. Ans: 1

Sol: $R = \frac{\rho l}{A} \Rightarrow \rho = \frac{RA}{l} = \frac{V}{l}.\frac{A}{l} = \frac{2}{4}\times\frac{1\times10^{-6}}{0.5}$

$= 10^{-6}\Omega - m$

33. Ans: 3

Sol: Since the same cell is used,

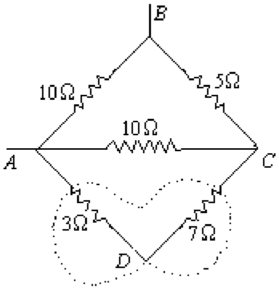
$V = i_1(R_1+r) = i_2(R_2+r)$

$\Rightarrow 0.5(11+R) = (0.5+0.4)(5+r)$

$\Rightarrow r = 2.5\Omega$

34. Ans: 2

Sol:



(i) From the circuit, $3\Omega \,\&\, 7\Omega$ resistors are in series. Their resultant resistance is 10Ω

(ii) 10Ω and are in parallel and their resultant is 5Ω

(iii) 5Ω and 5Ω are in series and are parallel to 10Ω

35. Ans.3

Sol: $\frac{X}{R} = \frac{l_1}{100 - l_1} \Rightarrow \frac{2}{3} = \frac{l_1}{100 - l_1}$

$200 - 2l_1 = 3l_1 \Rightarrow 200 = 5l_1$

$l_1 = 40cm$

36. **S** $R = \frac{\rho l}{A} \Rightarrow l = \frac{RA}{\rho} = \frac{R\pi r^2}{\rho}$

$= 4 \times \frac{22}{7} \times \frac{\left(0.7 \times 10^{-3}\right)^2}{2.2 \times 10^{-8}} = 280m$

37: As the P.D. between $4\,\Omega$ and $3\,\Omega$ (in parallel) are the same $\Rightarrow V = i_1 R_1 = i_2 R_2$

4 x 1 amp = 3 x i_1 $\quad \Rightarrow i_1 = \frac{4}{3}A$

Total resistance of $4\,\Omega$ and $3\,\Omega$ = 12/7 Ω [Since $R = \frac{R_1 R_2}{R_1 + R_2}$]

Current in MQP (upper one) = $1 + \frac{4}{3} = \frac{7}{3}A$

As V= iR $\therefore P.D. = \frac{12}{7} \times \frac{7}{3} = 4V$ $\quad$ Current in MNP = $\frac{4}{1.25} = \frac{4 \times 4}{5} = \frac{16}{5}$ A

$\therefore$ P.D across $1\,\Omega$ = $\frac{16}{5}A \times 1\Omega = \frac{16}{5}$ volt $\quad \Rightarrow$ P.D across $1\,\Omega$ = 3.2 volt

38. Percentage change in length $=\frac{\Delta L}{L}\times 100=10$

$\therefore\ \frac{\Delta l}{l}=0.1$

But the area also decreases by 0.1

Mass = $\rho lA=V_{\rho}$ In l + ln A = In mass

$\therefore \frac{\Delta l}{l}+\frac{\Delta A}{A}=0 \Rightarrow \frac{\Delta l}{l}=\frac{-\Delta A}{A}$

Length increases by 01., resistance increases, area decreases by 0.1, then also resistance will increase. Total increase in resistance is approximately 1.2 times, due to increase in length and decrease in area. But specific resistance does not change.

39. [In the question, the length 110cm & 100cm are interchanged as $\varepsilon>\frac{\varepsilon R}{R+r}$]

Without being short circuited through R, only the battery ε is balanced.

$\varepsilon=\frac{V}{L}\times l_1=\frac{V}{L}\times l_2$

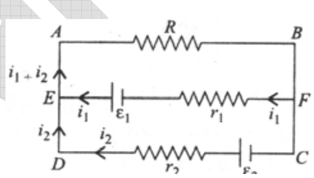
$\Rightarrow \frac{R\varepsilon}{R+r}=\frac{V}{L}\times 100$

Dividing eqn, (i) and (ii), $\frac{(R+r)}{R}=\frac{110}{100}$

$\Rightarrow 1+\frac{r}{R}=\frac{110}{100} \Rightarrow \frac{r}{R}=\frac{110}{100}-\frac{100}{100}$

$\Rightarrow r=R.\frac{10}{100}=\frac{R}{10}.$ As R = 10Ω ; r = 1 Ω

40.



Applying Kirchhoff's equation to the loop ABFE,

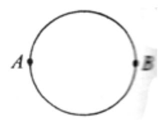
$(-i_1+i_2)R - i_1r_1 + \varepsilon_1=0$

Or $\varepsilon_1 - (i_1+i_2)R - i_1r_1=0$

41. Total length of wire = $2\pi r$

$$= 2\pi \times 10 \times 10^{-2}$$

$$= 2\pi \times 10^{-1}\text{m}$$

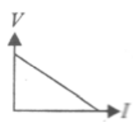


Total resistance = $2\pi \times 10^{-1} \times 12$

$\therefore$ Resistance of each part = $\dfrac{2\pi \times 12 \times 10^{-1}}{2} = 1.2\pi\Omega$

As two are parts in parallel $\therefore R_e = \dfrac{R}{2} = 0.6\ \pi\Omega$

42.



V = ε-Ir, equation (1) is in the form of y=c-mx (2)

Comparing (1) and (2)

$\therefore$ Slope = -r, (internal resistance)

V_{max} = emf ε. This is intercept of the y-axis.

$\therefore$ Slope is negative.

$\because$ I decrease as R increases.

43. Energy = 2 eV = eEλ

$$\therefore E = \frac{V}{\lambda} = \frac{2}{4 \times 10^{-8}} = 5 \times 10^{7}\ \text{V/m}$$