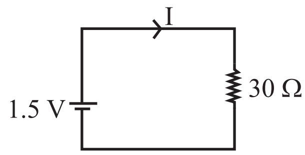
11 Electricity

Multiple Choice Questions (MCQs)

DIRECTIONS : *This section contains multiple choice questions. Each question has four choices (a), (b), (c) and (d) out of which only one is correct.*

1. The charge of 150 coulomb flows through a wire in one minute. What is the electric current flowing through it?
(a) 2.5 A (b) 3.5 A
(c) 4.5 A (d) 5.5 A

2. Find the current I flown in the circuit
(a) 0.05 A
(b) 5 A
(c) 50 A
(d) 500 A



3. A current of 10 A flows through a conductor for 2 minutes. What is the amount of charge passed through the conductor?
(a) 1200 C (b) 150 C
(c) 18 C (d) 1.8 C

4. A current of 10 A flows through a conductor for 2 minutes. Find the total number of electrons flowing through the conductor.
(a) 75×10^{20} (b) 70×10^{15}
(c) 60×10^{15} (d) 11×10^{12}

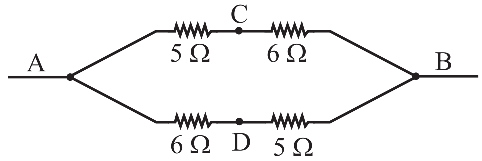
5. A metal wire 80 cm long and 1.00 mm^2 in cross-section has a resistance of 0.92 ohm. It's resistivity is:
(a) 0.000 115 ohm m (b) 0.0 115 ohm m
(c) 1.15 ohm m (d) None of these

6. 1 Ampere is equivalent to:
(a) $\frac{1\,\text{coulomb}}{1\,\text{sec}}$ (b) $\frac{1\,\text{volt}}{1\,\text{sec}}$
(c) $\frac{1\,\text{volt meter}}{1\,\text{sec}}$ (d) None

7. Device used to measure electric current is:
(a) Ammeter (b) Voltmeter
(c) Galvanometer (d) Generator

8. Reciprocal of resistance is called:
(a) Inductance (b) Conductance
(c) Resistivity (d) None of these

9. Find the equivalent resistance between A and B of following circuit:

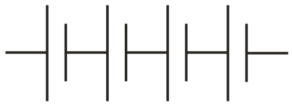


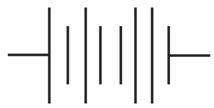
(a) $\frac{6}{2}\,\Omega$ (b) $\frac{5}{2}\,\Omega$
(c) $\frac{11}{2}\,\Omega$ (d) $\frac{1}{2}\,\Omega$

10. The maximum resistance which can be made using four resistors each of resistance $\frac{1}{2}\,\Omega$ is **[CBSE 2020]**
(a) 2Ω (b) 1 Ω
(c) 2.5 Ω (d) S Ω

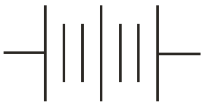
11. A current of 1 A is drawn by a filament of an electric bulb. Number of electrons passing through a cross section of the filament in 16 seconds would be roughly
(a) 10^{20} (b) 10^{16}
(c) 10^{18} (d) 10^{23}

12. The proper representation of series combination of cells (Figure) obtaining maximum potential is

(i) 

(ii) 

(iii) 

(iv) 

(a) (i) (b) (ii)
(c) (iii) (d) (iv)

13. A cylindrical conductor of length *l* and uniform area of crosssection *A* has resistance *R*. Another conductor of length 2*l* and resistance *R* of the same material has area of cross section **[CBSE 2020]**
(a) *A*/2 (b) 3*A*/2
(c) 2*A* (d) 3*A*

14. If 'i' is the current flowing through a conductor of resistance 'R' for time 't'. then the heat produced (Q) is given by
(a) $\frac{i^2R}{t}$ (b) $\frac{iR^2}{t}$
(c) i^2Rt (d) iRt^2

15. An electric kettle consumes 1 kW of electric power when operated at 220 V. A fuse wire of what rating must be used for it?
(a) 1 A (b) 2 A
(c) 4 A (d) 5 A

16. A cylindrical rod is reformed to twice its length with no change in its volume. If the resistance of the rod was *R*, the new resistance will be
(a) *R* (b) 2*R*
(c) 4*R* (d) 8*R*

17. What is the current through a 5.0 ohm resistor if the voltage across it is 10*V*
(a) zero (b) 0.50 *A*
(c) 2.0 *A* (d) 5.0 A

18. The length of a wire is doubled and the radius is doubled. By what factor does the resistance change
(a) 4 times as large (b) twice as large
(c) unchanged (d) half as large

19. Resistance of a metallic conductor depends on _______.
(a) its length (b) its area of cross section
(c) its temperature (d) All the above

20. A 24V potential difference is applied across a parallel combination of four 6 ohm resistor. The current in each resistor is
(a) 1 A (b) 4 A
(c) 16 A (d) 36 A

21. Three resistances of 2Ω, 3Ω and 5Ω are connected in parallel to a 10V battery of negligible internal resistance. The potential difference across the 3Ω resistance will be
(a) 2 V (b) 3 V
(c) 5 V (d) 10 V

22. Two unequal resistances are connected in parallel. Which of the following statement is true
(a) current in same in both
(b) current is larger in higher resistance
(c) voltage-drop is same across both
(d) voltage-drop is lower in lower resistance

23. You are given *n* identical wires, each of resistance R. When these are connected in parallel, the equivalent resistance is X. When these will be connected in series, then the equivalent resistance will be
(a) X/n^2 (b) n^2X
(c) X/n (d) nX

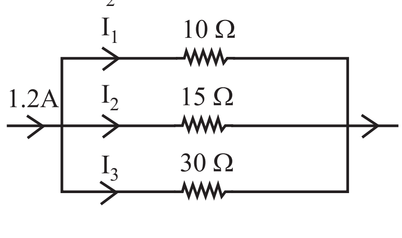
24. A piece of wire of resistance R is cut into five equal parts. These parts are then connected in parallel. If the equivalent resistance of this combination is R', then the ratio R/R' is
(a) 1/25 (b) 1/5
(c) 5 (d) 25

25. 2 ampere current is flowing through a conductor from a 10 volt emf source then resistance of conductor is
(a) 20 Ω (b) 5 Ω
(c) 12 Ω (d) 8 Ω

26. Charge on an electron is 1.6×10^{-19} coulomb. Number of electrons passing through the wire per second on flowing of 1 ampere current through the wire will be
(a) 0.625×10^{-19} (b) 1.6×10^{-19}
(c) 1.6×10^{-19} (d) 0.625×10^{19}

27. 20 coulomb charge is flowing in 0.5 second from a point in an electric circuit then value of electric current in amperes will be
(a) 10 (b) 40
(c) 0.005 (d) 0.05

28. In this circuit, the value of I_2 is
(a) 0.2 A
(b) 0.3 A
(c) 0.4 A
(d) 0.6 A



29. A letter 'A' is constructed of a uniform wire of resistance 1 ohm per cm. The sides of the letter are 20 cm and the cross piece in the middle is 10 cm long. The resistance between the ends of the legs will be
(a) 32.4 ohm (b) 28.7 ohm
(c) 26.7 ohm (d) 24.7 ohm

30. A wire of resistance R is cut into ten equal parts which are then joined in parallel. The new resistance is

(a) 0.01 R (b) 0.1 R
(c) 10 R (d) 100 R

31. If a wire is stretched to make its length three times, its resistance will become

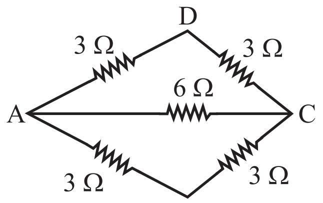
(a) three times (b) one-third
(c) nine times (d) one-ninth

32. The resistivity of a wire depends on

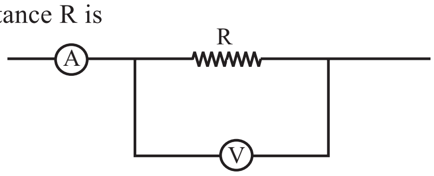
(a) length (b) area of cross-section
(c) material (d) All the above

33. The effective resistance between the points A and B in the figure is

(a) 5 Ω
(b) 2 Ω
(c) 3 Ω
(d) 4 Ω

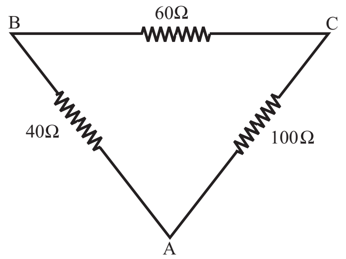


34. In the circuits shown below the ammeter A reads 4 amp. and the voltmeter V reads 20 volts. The value of the resistance R is



(a) slightly more than 5 ohms
(b) slightly less than 5 ohms
(c) exactly 5 ohms
(d) None of the above

35. Three resistors are connected to form the sides of a triangle ABC as shown below.



The resistance of side AB is 40 ohms, of side BC 60 ohms and of side CA 100 ohms. The effective resistance between the point A and B in ohms is

(a) 50 (b) 64
(c) 32 (d) 100

36. If one micro-amp. current is flowing in a wire, the number of electrons which pass from one end of the wire to the other end in one second is

(a) 6.25×10^{12} (b) 6.25×10^{15}
(c) 6.25×10^{18} (d) 6.25×10^{19}

37. The unit for specific resistance is

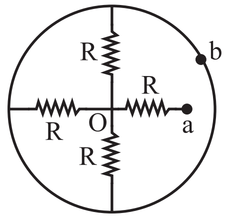
(a) ohm × second (b) ohm × m
(c) ohm (d) ohm/cm

38. If the temperature of a conductor is increased, its resistance will

(a) not increase
(b) increase
(c) decrease
(d) change according to the whether

39. The equivalent resistance between points a and b of a network shown in the figure is given by

(a) $\frac{3}{4}$R
(b) $\frac{4}{3}$R
(c) $\frac{5}{4}$R
(d) $\frac{4}{5}$R

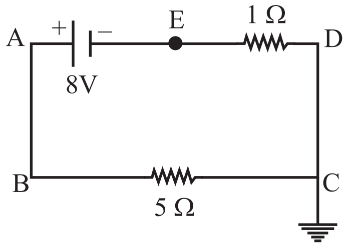


40. Two wires of resistance R_1 and R_2 are joined in parallel. The equivalent resistance of the combination is

(a) $R_1R_2/(R_1 + R_2)$ (b) $(R_1 + R_2)$
(c) $R_1 \times R_2$ (d) R_1/R_2

41. In the given circuit, the potential of the point E is

(a) Zero
(b) – 8 V
(c) – 4/3 V
(d) 4/3 V



42. The resistance of a thin wire in comparison of a thick wire of the same material

(a) is low
(b) is equal
(c) depends upon the metal of the wire
(d) is high

43. If the specific resistance of a wire of length l and radius r is k then resistance is

(a) $k\pi r^2/l$ (b) $\pi r^2/lk$
(c) $kl/\pi r^2$ (d) k/lr^2

44. If a charge of 1.6×10^{-19} coulomb flows per second through any cross section of any conductor, the current constitute will be

(a) 2.56×10^{-19} A (b) 6.25×10^{-19} A
(c) 1.6×10^{-19} A (d) 3.2×10^{-19} A

45. The number of electrons flowing per second through any cross section of wire, if it carries a current of one ampere, will be
(a) 2.5×10^{18} (b) 6.25×10^{18}
(c) 12.5×10^{18} (d) 5×10^{18}

46. The number of electron passing through a heater wire in one minute, if it carries a current of 8 ampere, will be
(a) 2×10^{20} (b) 2×10^{21}
(c) 3×10^{20} (d) 3×10^{21}

47. The heat produced in a wire of resistance '*x*' when a current '*y*' flow through it in time '*z*' is given by
(a) $x^2 \times y \times z$ (b) $y \times z^2 \times x$
(c) $x \times z \times y^2$ (d) $y \times z \times x$

48. In a wire of length 4m and diameter 6mm, a current of 120 ampere is passed. The potential difference across the wire is found to be 18 volt. The resistance of wire will be
(a) 0.15 ohm (b) 0.25 ohm
(c) 6.660 ohm (d) None of the these

49. The resistance of an incandescent lamp is
(a) greater when switched off
(b) smaller when switched on
(c) grater when switched on
(d) Same whether it is switched off or switched on

50. If resistance of a wire formed by 1.cc of copper be 2.46Ω. The diameter of wire is 0.32 mm, then the specific resistance of wire will be
(a) 1.59×10^{-6} ohm. cm (b) 2.32×10^{-6} ohm. cm
(c) 3.59×10^{-6} ohm. cm (d) 1.59×10^{-8} ohm. cm

51. A given piece of wire length ℓ, cross sectional area A and resistance R is stretched uniformly to a wire of length 2ℓ. The new resistance will be
(a) 2 R (b) 4 R
(c) R/2 (d) Remains unchanged

52. A given piece of wire of length ℓ, radius *r* and resistance R is stretched uniformly to a wire of radius (*r*/2). The new resistances will be
(a) 2 R (b) 4 R
(c) 8 R (d) 16 R

53. There are two wires of the same length and of the same material and radial *r* and 2*r*. The ratio of their specific resistance is
(a) 1 : 2 (b) 1 : 1
(c) 1 : 4 (d) 4 : 1

54. Specific resistance of a wire depends on the
(a) length of the wire
(b) area of cross-section of the wire
(c) resistance of the wire
(d) material of the wire

55. The resistance of some substances become zero at very low temperature, then these substances are called
(a) good conductors (b) super conductors
(c) bad conductors (d) semi conductors

56. The resistance of wire is 20Ω. The wire is stretched to three time its length. Then the resistance will now be
(a) 6.67 Ω (b) 60 Ω
(c) 120 Ω (d) 180 Ω

57. When the resistance of copper wire is 0.1 Ω and the radius is 1 mm, then the length of the wire is (specific resistance of copper is 3.14×10^{-8} ohm × m)
(a) 10 cm (b) 10 m
(c) 100 m (d) 100 cm

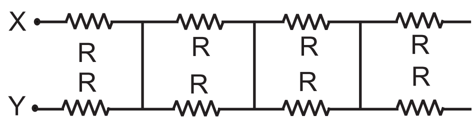
58. When the resistance wire is passed through a die the cross-section area decreases by 1%, the change in resistance of the wire is
(a) 1% decrease (b) 1% increase
(c) 2% decrease (d) 2% increase

59. The lowest resistance which can be obtained by connecting 10 resistors each of $\frac{1}{10}$ ohm is
(a) $\frac{1}{250}\Omega$ (b) $\frac{1}{200}\Omega$
(c) $\frac{1}{100}\Omega$ (d) $\frac{1}{10}\Omega$

60. The resistance 4*R*, 16*R*, 64*R*, ...∞ are connected in series, their resultant will be
(a) 0 (b) ∞
(c) 4/3 R (d) 3/4 R

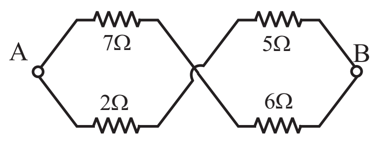
61. Resistance R, 2R, 4R, 8R .... ∞ are connected in parallel. Their resultant resistance will be
(a) R (b) R/2
(c) 0 (d) ∞

62. The equivalent resistance between points X and Y is



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

63. The equivalent resistance between points A and B is



(a) 4Ω (b) 4.5 Ω
(c) 2 Ω (d) 20 Ω

64. Three resistances 4Ω each of are connected in the form of an equilateral triangle. The effective resistance between two corners is

(a) 8Ω (b) 12Ω
(c) 3/8 Ω (d) 8/3 Ω

65. Two wires of same metal have the same length but their cross-sections area in the ratio 3 : 1. They are joined in series. The resistance of the thicker wire is 10Ω. The total resistance of the combination will be

(a) 40 Ω (b) 40/3 Ω
(c) 5/2 Ω (d) 100 Ω

66. A certain piece of silver of given mass is to be made like a wire. Which of the following combination of length (L) and the area of cross-sectional (A) will lead to the smallest resistance

(a) L and A
(b) 2L and A/2
(c) L/2 and 2A
(d) Any of the above, because volume of silver remains same

67. A certain wire has a resistance R. The resistance of another wire identical with the first except having twice of its diameter is

(a) 2 R (b) 0.25 R
(c) 4 R (d) 0.5 R

68. What length of the wire of specific resistance 48×10^{-8} Ω-m is needed to make a resistance of 4.2 Ω (diameter of wire = 0.4 mm)

(a) 4.1 m (b) 3.1 m
(c) 2.1 m (d) 1.1 m

69. The resistance of an ideal voltmeter is

(a) zero (b) very low
(c) very large (d) Infinite

70. Masses of 3 wires of same metal are in the ratio 1 : 2 : 3 and their lengths are in the ratio 3 : 2 : 1. The electrical resistances are in ratio

(a) 1 : 4 : 9 (b) 9 : 4 : 1
(c) 1 : 2 : 3 (d) 27 : 6 : 1

71. We have two wires A and B of same mass and same material. The diameter of the wire A is half of that B. If the resistance of wire A is 24 ohm then the resistance of wire B will be

(a) 12 ohm (b) 3.0 ohm
(c) 1.5 ohm (d) None of the above

72. The electric resistance of a certain wire of iron is R. If its length and radius are both doubled, then

(a) The resistance will be doubled and the specific resistance will be halved
(b) The resistance will be halved and the specific resistance will remain unchanged
(c) The resistance will be halved and the specific resistance will be doubled
(d) The resistance and the specific resistance, will both remain unchanged

73. When a wire of uniform cross-section a, length ℓ and resistance R is bent into a complete circle, resistance between any two of diametrically opposite points will be

(a) $R/4$ (b) $R/8$
(c) $4R$ (d) $R/2$

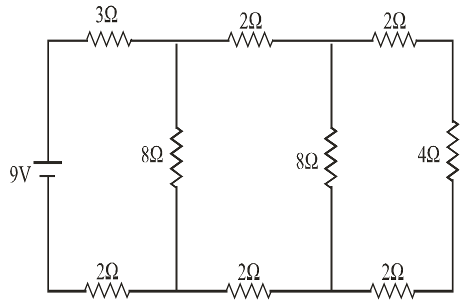
74. A solenoid is at potential difference 60V and current flows through it is 15 ampere, then the resistance of coil will be

(a) 4 Ω (b) 8 Ω
(c) 0.25 Ω (d) 2 Ω

75. A strip of copper and another of germanium are cooled from room temperature to 80 K. The resistance of

(a) Each of these increases
(b) Each of these decreases
(c) Copper strip increases and that of germanium decreases
(d) Copper strip decreases and that of germanium increases

76. In the circuit shown in the figure, the current through



(a) the 3Ω resistor is 0.50A
(b) the 3Ω resistor is 0.25A
(c) the 4Ω resistor is 0.50A
(d) the 4Ω resistor is 0.25A

77. Two electric lamps each of 100 watts 220V are connected in series to a supply of 220 volts. The power consumed would be –

(a) 100 watts (b) 200 watts
(c) 25 watts (d) 50 watts

78. If it takes 8 minutes to boil a quantity of water electrically, how long will it take to boil the same quantity of water using the same heating coil but with the current doubled

(a) 32 minutes (b) 16 minutes
(c) 4 minutes (d) 2 minutes

79. An electric bulb is filled with

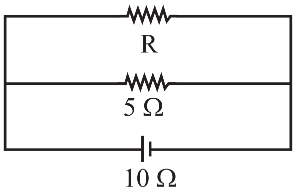
(a) hydrogen (b) oxygen and hydrogen
(c) ammonia (d) nitrogen and argon

80. When current is passed through an electric bulb, its filament glows, but the wire leading current to the bulb does not glow because

(a) less current flows in the leading wire as compared to that in the filament
(b) the leading wire has more resistance than the filament
(c) the leading wire has less resistance than the filament
(d) filament has coating of fluorescent material over it

81. Which of the following terms does not represent electrical power in a circuit?
(a) I^2R (b) IR^2
(c) VI (d) V^2/R

82. The power dissipated in the circuit shown in the figure is 30 watts. The value of R is
(a) 20 Ω
(b) 15 Ω
(c) 10 Ω
(d) 30 Ω



83. The filament of an electric bulb is of tungsten because
(a) Its resistance is negligible
(b) It is cheaper
(c) Its melting point is high
(d) Filament is easily made

84. When the current passes through the filament, it gets heated to incandescence and give light while the connecting wires are not heated because
(a) The connecting wires are good conductor of heat while the filament is bad conductor
(b) The connecting wires are of low resistance while the filament is of high resistance
(c) The density of connecting wires is less than that of the filament
(d) The connecting wires are bad conductor of heat while the filament is good conductor

85. Which one of the following heater element is used in electric press
(a) copper wire (b) nichrome wire
(c) lead wire (d) iron wire

86. What should be the characteristic of fuse wire?
(a) High melting point, high specific resistance
(b) Low melting point, low specific resistance
(c) High melting point, low specific resistance
(d) Low melting point, high specific resistance

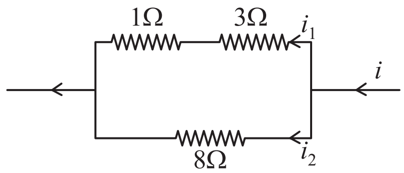
87. The heating element of an electric heater should be made with a material, which should have
(a) high specific resistance and high melting point
(b) high specific resistance and low melting point
(c) low specific resistance and low melting point
(d) low specific resistance and high melting point

88. Resistance of conductor is doubled keeping the potential difference across it constant. The rate of generation of heat will
(a) become one fourth (b) be halved
(c) be doubled (d) become four times

89. A current I passes through a wire of length l, radius r and resistivity ρ. The rate of heat generated is
(a) $\frac{I^2\rho\ell}{r}$ (b) $\frac{I^2\rho\ell}{\pi r^2}$
(c) $\frac{I^2\rho\ell}{\pi r}$ (d) none of these

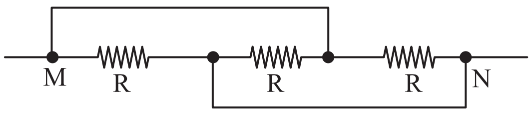
90. The resistance R_1 and R_2 are joined in parallel and a current is passed so that the amount of heat liberated is H_1 and H_2 respectively. The ratio H_1/H_2 has the value
(a) R_2/R_1 (b) R_1/R_2
(c) R_1^2/R_2^2 (d) R_2^2/R_1^2

91. Power dissipated across the 8Ω resistor in the circuit shown here is 2 watt. The power dissipated in watt units across the 3Ω resistor is
(a) 1.0
(b) 0.5
(c) 3.0
(d) 2.0



92. In house electrical circuits the fuse wire for safety should be of
(a) High resistance – high melting point
(b) Low resistance – high melting point
(c) Low resistance – low melting point
(d) High resistance – low melting point

93. What is the equivalent resistance of the following arrangement between M and N

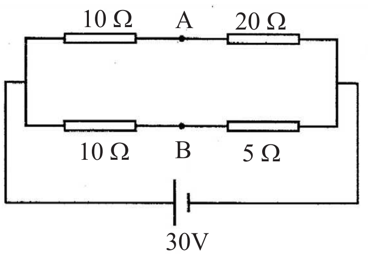


(a) R/2 (b) R/3
(c) R/4 (d) R/6

94. If a wire of resistance 1Ω is stretched to double its length, then resistance will be
(a) $\frac{1}{2}\Omega$ (b) 2 Ω
(c) $\frac{1}{4}\Omega$ (d) 4 Ω

95. Across a metallic conductor of non-uniform cross section a constant potential difference is applied. The quantity which remains constant along the conductor is :
(a) current (b) drift velocity
(c) electric field (d) current density

96. In the circuit diagram shown below, V_A and V_B are the potentials at points A and B respectively. Then, $V_A - V_B$ is



(a) –10 V (b) –20 V
(c) 0 V (d) 10 V

97. The diameter of a wire is reduced to one-fifth of its original value by stretching it. If its initial resistance is R, what would be its resistance after reduction of the diameter?

(a) $\frac{R}{625}$ (b) $\frac{R}{25}$
(c) 25 R (d) 625 R

98. A heater coil is cut into two equal parts and only one part is used in the heater, the heat generated now will be
(a) doubled (b) four times
(c) one fourth (d) halved

99. The resistance of a wire is R. After melting it is remouled such that its area of cross section becomes n times its initial area of cross section. It new resistance will be

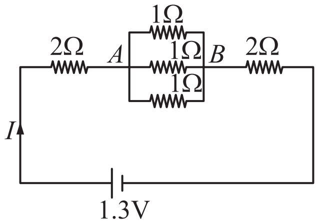
(a) nR (b) $\frac{R}{n}$
(c) n^2R (d) $\frac{R}{n^2}$

100. The resistance of a wire is 'R' ohm. If it is melted and stretched to 'n' times its original length, its new resistance will be :

(a) $\frac{R}{n}$ (b) n^2R
(c) $\frac{R}{n^2}$ (d) nR

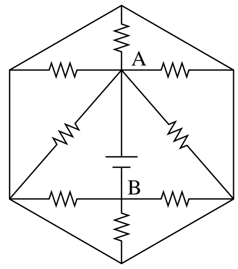
101. Three electric bulbs of rating 40 W – 200 V; 50 W – 200 V and 100 W – 200 V are connected in series to a 600 V supply. What is likely to happen as the supply is switched on?
(a) Only 50 W bulb will fuse
(b) Both 40 W and 50 W bulbs will fuse.
(c) All the three bulbs will emit light with their rated powers.
(d) 100 W bulb will emit light of maximum intensity.

102. In the circuit given, the ratio of work done by the battery to maintain the current between point A and B to the work done for the whole circuit is



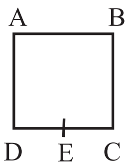
(a) $\frac{1}{117}$ (b) $\frac{1}{13}$
(c) $\frac{1}{12}$ (d) 1

103. What is the current supplied by the battery in the circuit shown below? Each resistance used in circuit is of 1 kΩ and potential difference V_{AB}= 8V



(a) 64 mA
(b) 15 mA
(c) 9.87 mA
(d) 1 mA

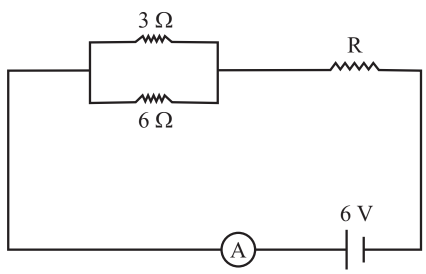
104. A wire of resistance R is bent to form a square ABCD as shown in the figure. The effective resistance between E and C is: (E is mid-point of arm CD)



(a) R (b) $\frac{7}{64}$R
(c) $\frac{3}{4}$R (d) $\frac{1}{16}$R

105. Which of the following acts as a circuit protection device?
(a) conductor (b) inductor
(c) switch (d) fuse

106. If the ammeter in the given circuit reads 2 A, What is the value of resistence R (the resistance of ammeter is negligible).



(a) 1 Ω (b) 2 Ω
(c) 3 Ω (d) 4 Ω

107. A circuit to verify Ohm's law uses ammeter and voltmeter in series or parallel connected correctly to the resistor. In the circuit :

(a) ammeter is always used in parallel and voltmeter is series

(b) Both ammeter and voltmeter must be connected in parallel

(c) ammeter is always connected in series and voltmeter in parallel

(d) Both, ammeter and voltmeter must be connected in series

108. An electric bulb is rated 220V and 100W. When it is operated on 110V, the power consumed will be

(a) 100W (b) 75W

(c) 50W (d) 25W

109. From a power station, the power is transmitted at a very high voltage because –

(a) it is generated only at high voltage

(b) it is cheaper to produce electricity at high voltage

(c) electricity at high voltage is less dangerous

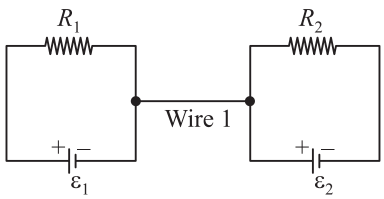
(d) there is less loss of energy in transmission at high voltage

110. Two electric bulbs rated P_1 watt V volts and P_2 watt V volts are connected in parallel and applied across V volts. The total power (in watts) will be

(a) $P_1 + P_2$ (b) $\sqrt{P_1 P_2}$

(c) $\frac{P_1 P_2}{P_1 + P_2}$ (d) $\frac{P_1 + P_2}{P_1 P_2}$

111. In the circuit, wire 1 is of negligible resistance. Then,



(a) current will flow through wire 1, if $\varepsilon_1 \neq \varepsilon_2$

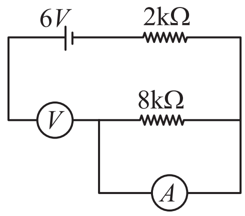
(b) current will flow through wire 1, if $\frac{\varepsilon_1}{R_1} \neq \frac{\varepsilon_2}{R_2}$

(c) current will flow through wire 1, if

$$\frac{\varepsilon_1 + \varepsilon_2}{(R_1 + R_2)} \neq \frac{\varepsilon_1 - \varepsilon_2}{(R_1 - R_2)}$$

(d) no current will flow through wire 1

112. In the circuit shown below, a student performing Ohm's law experiment accidently puts the voltmeter and the ammeter as shown in the circuit below. The reading in the voltmeter will be close to



(a) 0 V

(b) 4.8 V

(c) 6.0 V

(d) 1.2 V

113. A student in a town in India, where the price per unit (1 unit = 1 kW-hr) of electricity is ₹5.00, purchases a 1 kVA UPS (uninterrupted power supply) battery. A day before the exam, 10 friends arrive to the student's home with their laptops and all connect their laptops to the UPS. Assume that each laptop has a constant power requirement of 90 W. Consider the following statements

I All the 10 laptops can be powered by the UPS if connected directly.

II All the 10 laptops can be powered if connected using an extension box with a 3A fuse.

III If all the 10 friends use the laptop for 5 hours, then the cost of the consumed electricity is about ₹22.50.

Select the correct option with the true statements.

(a) I only (b) I and II only

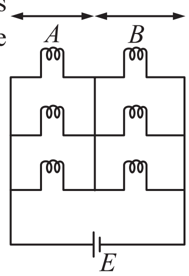
(c) I and III only (d) II and III only

114. A copper wire is stretched to make it 0.5% longer. The percentage change in its electrical resistance if its volume remains unchanged is:

(a) 2.0% (b) 2.5%

(c) 1.0% (d) 0.5%

115. Six similar bulbs are connected as shown in the figure with a DC source of emf E, and zero internal resistance.



The ratio of power consumption by the bulbs when (i) all are glowing and (ii) in the situation when two from section A and one from section B are glowing, will be:

(a) 4 : 9 (b) 9 : 4

(c) 1 : 2 (d) 2 : 1

Case/Passage Based Questions

DIRECTIONS : *Study the given case/passage and answer the following questions.*

Case/Passage - 1

Two tungston lamps with resistances R_1 and R_2 respectively at full incandescence are connected first in parallel and then in series, in a lighting circuit of negaligible internal resistance. It is given that: $R_1 > R_2$.

116. Which lamp will glow more brightly when they are connected in parallel?
(a) Bulb having lower resistance
(b) Bulb having higher resistance
(c) Both the bulbs
(d) None of the two bulbs

117. If the lamp of resistance R_1 now burns out, how will the illumination produced change?
(a) Net illumination will increase
(b) Net illumination will decrease
(c) Net illumination will remain same
(d) Net illumination will reduced to zero

118. Which lamp will glow more brightly when they are connected in series?
(a) Bulb having lower resistance
(b) Bulb having higher resistance
(c) Both the bulbs
(d) None of the two bulbs

119. If the lamp of resistance R_2 now burns out and the lamp of resistance R_1 alone is plugged in, will the illumination increase or decrease?
(a) Illumination will remain same
(b) Illumination will increase
(c) Illumination will decrease
(d) None

120. Would physically bending a supply wire cause any change in the illumination?
(a) Illumination will remain same
(b) Illumination will increase
(c) Illumination will decrease
(d) It is not possible to predict from the given datas

Case/Passage - 2

The rate at which electric energy is dissipated or consumed in an electric circuit. This is termed as electric power,

$P = IV$, According to Ohm's law $V = IR$

We can express the power dissipated in the alternative forms

$$P = I^2R = \frac{V^2}{R}$$

If 100W – 220V is written on the bulb then it means that the bulb will consume 100 joule in one second if used at the potential difference of 220 volts. The value of electricity consumed in houses is decided on the basis of the total electric energy used. Electric power tells us about the electric energy used per second not the total electric energy.

The total energy used in a circuit = power of the electric circuit × time.

121. Which of the following terms does not represent electrical power in a circuit?
(a) I^2R (b) IR^2
(c) VI (d) V^2/R

122. An electric bulb is rated 220V and 100W. When it is operated on 110V, the power consumed will be–
(a) 100 W (b) 75 W
(c) 50 W (d) 25 W

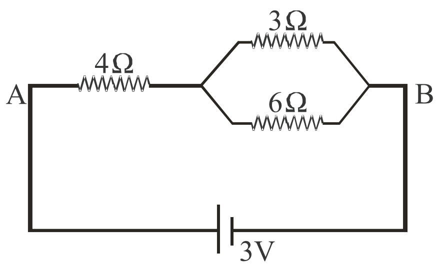
123. Two conducting wires of the same material and of equal lengths and equal diameters are first connected in sereis and then in parallel in an electric circuit. The ratio of heat produced in series and in parallel combinations would be–
(a) 1 : 2 (b) 2 : 1
(c) 1 : 4 (d) 4 : 1

124. In an electrical circuit three incandescent bulbs. A, B and C of rating 40 W, 60 W and 100 W, respectively are connected in parallel to an electric source. Which of the following is likely to happen regarding their brightness?
(a) Brightness of all the bulbs will be the same
(b) Brightness of bulb *A* will be the maximum
(c) Brightness of bulb *B* will be more than that of *A*
(d) Brightness of bulb *C* will be less than that of *B*

125. In an electrical circuit, two resistors of 2Ω and 4Ω respectively are connected in series to a 6V battery. The heat dissipated by the 4Ω resistor in 5s will be
(a) 5 J (b) 10 J
(c) 20 J (d) 30 J

Case/Passage - 3

Answer the following questions based on the given circuit.



126. The potential drop across the 3Ω resistor is
(a) 1 V (b) 1.5 V
(c) 2 V (d) 3 V

127. The equivalent resistance between points A and B is
(a) 7Ω (b) 6Ω
(c) 13Ω (d) 5Ω

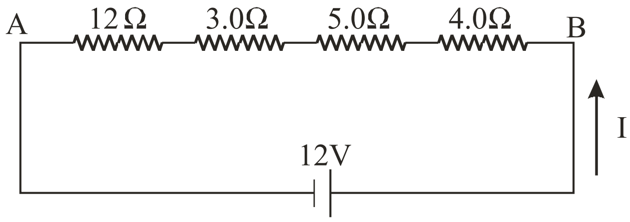
128. The current flowing through in the given circuit is

(a) 0.5 A (b) 1.5 A

(c) 6 A (d) 3 A

Case/Passage - 4

Answer the following questions based on the given circuit.



129. The equivalent resistance between points A and B, is

(a) 12 Ω (b) 36 Ω

(c) 32 Ω (d) 24 Ω

130. The current through each resistor is

(a) 1 A (b) 2.3 A

(c) 0.5 A (d) 0.75 A

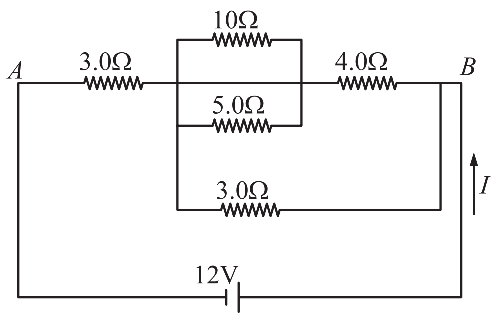
131. The potential drop across the 12Ω resistor is

(a) 12 V (b) 6 V

(c) 8 V (d) 0.5 V

Case/Passage - 5

Answer the following questions based on the given circuit.



132. The equivalent resistance between points A and B

(a) 6.2 Ω (b) 5.1 Ω

(c) 13.33 Ω (d) 1.33 Ω

133. The current through the battery is

(a) 2.33 A (b) 3.12 A

(c) 4.16 A (d) 5.19 A

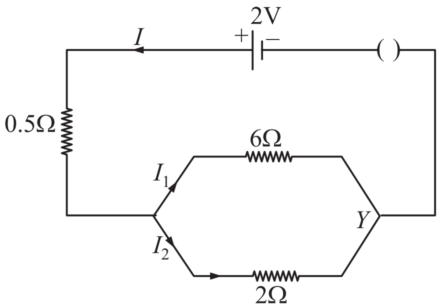
134. The current through the 4.0 ohm resistor is

(a) 5.6 A (b) 0.98 A

(c) 0.35 A (d) 0.68 A

Case/Passage - 6

Answer the following questions based on the given circuit.



135. The total resistance of the circuit is

(a) 2 Ω (b) 4 Ω

(c) 1.5 Ω (d) 0.5 Ω

136. The current flowing through 0.5Ω resistor is

(a) 1 A (b) 1.5 A

(c) 3 A (d) 2.5 A

137. The current flowing through 6Ω resistor is

(a) 0.50 A (b) 0.75 A

(c) 0.80 A (d) 0.25

Assertion & Reason

DIRECTIONS : *Each of these questions contains an assertion followed by reason. Read them carefully and answer the question on the basis of following options. You have to select the one that best describes the two statements.*

(a) If both **Assertion** and **Reason** are **correct** and Reason is the **correct explanation** of Assertion.

(b) If both **Assertion** and **Reason** are correct, but Reason is **not the correct explanation** of Assertion.

(c) If **Assertion** is **correct** but **Reason** is **incorrect**.

(d) If **Assertion** is **incorrect** but **Reason** is **correct**.

138. Assertion : Fuse wire must have high resistance and low melting point.

Reason : Fuse is used for very small current flow only.

139. Assertion : Alloys are commonly used in electrical heating devices like electric iron and heater.

Reason : Resistivity of an alloy is generally higher than that of its constituent metals but the alloys have low melting points than their constituent metals.

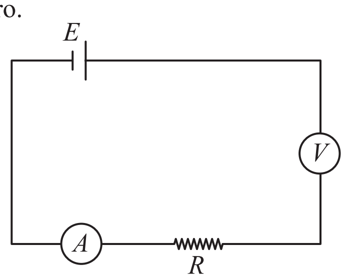
140. Assertion : In a simple battery circuit, the point of lowest potential is negative terminal of the battery.

Reason : The current flows towards the point of higher potential as it flows in such a circuit from the negative to positive terminal.

141. Assertion : The equation $V = Ri$ can be applied to those conducting devices which do not obey Ohm's law.

Reason : V = Ri is a statement of Ohm's law.

142. Assertion : All electric devices shown in the circuit are ideal. The reading of each of ammeter (A) and voltmeter (V) is zero.



Reason : An ideal voltmeter draws almost no current due to very large resistance, and hence (A) will read zero.

143. Assertion : If ρ_1 and ρ_2 be the resistivities of the materials of two resistors of resistances R_1 and R_2 respectively and $R_1 > R_2$, then $\rho_1 > \rho_2$.

Reason : The resistance $R = \rho\frac{\ell}{A} \Rightarrow \rho_1 > \rho_2$ if $R_1 > R_2$

144. Assertion : Insulators do not allow flow of current through themselves.
Reason : They have no free-charge carriers.

145. Assertion : Positive charge inside the cell always goes from positive terminal to the negative terminal.
Reason : Positive charge inside the cell may go from negative terminal to the positive terminal.

146. Assertion : Wire A is thin in comparison to wire B of same material and same length then resistance of wire A is greater than resistance of wire B.
Reason : Resistivity of wire A is greater than resistivity of wire B.

147. Assertion : Resistivity of material may change with temperature.
Reason : Resistivity is a material property & independent on temperature.

148. Assertion : When current through a bulb decreases by 0.5%, the glow of bulb decreases by 1%.
Reason : Glow (Power) which is directly proportional to square of current.

149. Assertion : Long distance power transmission is done at high voltage.
Reason : At high voltage supply power losses are less.

150. Assertion : Resistance of 50W bulb is greater than that of 100 W.
Reason : Resistance of bulb is inversely proportional to rated power.

151. Assertion : A resistor of resistance R is connected to an ideal battery. If the value of R is decreased, the power dissipated in the circuit will increase.

Reason : The power dissipated in the circuit is directly proportional to the resistance of the circuit.

Match the Following

DIRECTIONS : *Each question contains statements given in two columns which have to be matched. Statements (A, B, C, D) in column I have to be matched with statements (p, q, r, s) in column II.*

152.

Column I	Column II
(A) Ohm	(p) $\frac{\rho L}{A}$
(B) Resistance	(q) $\frac{1 \text{ volt}}{1 \text{ ampere}}$
(C) Resistivity	(r) zero resistance
(D) Super conductor	(s) ohm-meter

153. Column II gives name of material use for device given in column I

Column I	Column II
(A) Resistance of resistance box	(p) tungsten
(B) Fuse wire	(q) maganin
(C) Bulb	(r) tin-lead alloy
(D) Insulator	(s) glass

Fill in the Blanks

DIRECTIONS : *Complete the following statements with an appropriate word / term to be filled in the blank space(s).*

154. The rate of flow of electric charge is called ....

155. If there is no current, a voltmeter connected across a resistor will register..................... voltage.

156. Combined resistance is the sum of separate resistances provided that the various conductors are connected in ....

157. In a parallel circuit, each circuit element has the same ....

158. Copper is a preferred material for making wire because of its low........................

159. The S.I. unit of electric current is ....

160. .... is a property that resists the flow of electrons in a conductor.

161. The S.I. unit of resistance is ....

162. The potential difference across the ends of a resistor is .... to the current through it, provided its .... remains the same.

163. The resistance of a conductor depends directly on its ...., inversely on its ...., and also directly proportioned on the .... of the conductor.

164. 1 volt × 1 coulomb = ...

165. Potential difference is a .... quantity.

166. The resistance of a semiconductor .... with increase in temp.

167. The S.I. unit of resistivity is ....

168. Physical quantity represented by coulomb per second is ....

169. Two resistances of 2 Ω each are connected in parallel. The equivalent resistance is ....

170. The resistance of a wire is .... proportional to the square of its radius.

171. Kilowatt is the unit of electrical .... but kilowatt-hour is the unit of electrical ....

172. Energy spent in kilowatt-hour

$$\frac{\text{volt} \times .... \times ....}{1000}$$

173. A fuse is a short piece of wire of high .... and low ....

174. Fuse wire has a .... melting point and is made of an alloy of ....and .... If the current in a circuit rises too high, the fuse wire ....

175. A fuse is connected in .... to the .... wire.

176. Electric energy is produced by the .... of charges.

177. Energy converted per unit charge is measured with an instrument called a ....

178. The electrical energy dissipated in a resistor is given by W = ...

179. The unit of power is ....

180. One watt of power is consumed when 1 A of current flows at a potential difference of ....

181. 1 kW h = ...

182. The alloy which is used for making the filament of bulbs is ....

183. Power transmission is carried out at high........................ and low ....

184. Rate at which electric work is done is called ....

True / False

DIRECTIONS : *Read the following statements and write your answer as true or false.*

185. The quantity of charge flowing through a point multiplied by time is a current.

186. The resistivity of all pure metals increases with the rise in temperature.

187. Ohm's law is a relation between the power used in a circuit to the current and the potential difference.

188. Direction of current is taken opposite to the direction of flow of electrons.

189. The equivalent resistance of several resistors in series is equal to the sum of their individual resistances.

190. In parallel combination, the reciprocal of equivalent resistance is the sum of the reciprocal of individual resistance.

191. The series arrangement is used for domestic circuits.

192. The reciprocal of resistance is called specific resistance.

193. Resistivity is measured in ohm-metre.

194. The resistance of a wire is directly proportional to length.

195. The resistance of a wire is directly proportional to area.

196. The resistivity of alloys decreases with the rise in temp.

197. The filament resistance of glowing bulb is greater, to its resistance when it is not glowing.

198. The commercial unit of electrical energy is kilowatt-hour (kWh).

199. Pure tungsten has high resistivity and a high melting point (nearly 3000°C).

200. When a metallic conductor is heated the atoms in the metal vibrate with greater amplitude and frequency.

201. One kilowatt is equal to 10 horse power.

202. Fuse is a thin wire which melts and breaks the electric circuit due to only high voltage.

ANSWER KEY & SOLUTIONS

1. **(a)** $Q = 150$ C, $t = 60$ sec so, $I = \frac{Q}{t} = \frac{150}{60} = 2.5\,A$

2. **(a)** $V = IR \Rightarrow I = \frac{V}{R} = \frac{1.5V}{30\Omega} = 0.05\,A$

3. **(a)** $Q = I \times t \Rightarrow Q = 10\text{ A} \times (2 \times 60\text{ sec}) = 1200\text{ C}$

4. **(a)** Charge on one electron $e = -1.6 \times 10^{-19}$ C

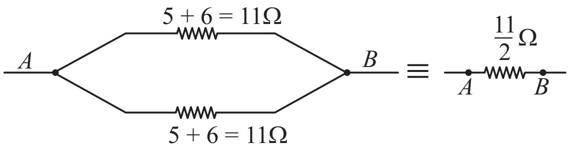
So, number of electrons flown

$$n = \frac{Q}{e} = \frac{10\times2\times60}{1.6\times10^{-19}} = 75\times10^{20}$$

5. **(a)** $R = \rho\frac{l}{A} \Rightarrow \rho = R\frac{A}{l} = 0.000115\,\Omega\,\text{m}$

6. **(a)** **7.** (a) **8.** (b)

9. **(c)** $R_{\text{equivalent}} = \frac{(5+6)}{2} = \frac{11}{2}\Omega$

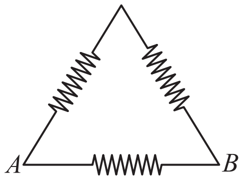


10. **(a)** To get the maximum resistance, all four resistors should be connected in series,

$$\therefore R = \frac{1}{2}\Omega + \frac{1}{2}\Omega + \frac{1}{2}\Omega + \frac{1}{2}\Omega = 2\Omega$$

11. **(a)**	**12.** **(a)**	**13.** **(c)**	**14.** **(c)**
15. **(d)**	**16.** **(c)**	**17.** **(c)**	**18.** **(d)**
19. **(d)**	**20.** **(b)**	**21.** **(d)**	**22.** **(c)**
23. **(b)**	**24.** **(d)**	**25.** **(b)**	**26.** **(d)**
27. **(b)**	**28.** **(c)**	**29.** **(c)**	**30.** **(b)**
31. **(c)**	**32.** **(c)**	**33.** **(b)**	**34.** **(a)**
35. **(c)**	**36.** **(b)**	**37.** **(b)**	**38.** **(b)**
39. **(b)**	**40.** **(a)**	**41.** **(c)**	**42.** **(d)**
43. **(c)**	**44.** **(c)**	**45.** **(b)**	**46.** **(d)**
47. **(a)**	**48.** **(a)**	**49.** **(c)**	**50.** **(a)**
51. **(b)**	**52.** **(d)**	**53.** **(b)**	**54.** **(d)**
55. **(b)**	**56.** **(d)**	**57.** **(b)**	**58.** **(d)**
59. **(b)**	**60.** **(b)**	**61.** **(b)**	**62.** **(b)**
63. **(b)**			

64. **(d)** $R_{AB} = \frac{(4+4)\times4}{4+4+4} = \frac{8}{3}\Omega$



65. **(a)** Same metal means same specific resistance

$\frac{R_1}{R_2} = \frac{A_2}{A_1} = \frac{1}{3} \Rightarrow R_2 = 3R_1 = 3 \times 10 = 30\ \Omega$

$R = R_1 + R_2 = 40\ \Omega$

66. **(c)** $R \propto \frac{\ell}{A}$. Hence minimum for option (c)

67. **(b)** $R \propto \frac{1}{A} \propto \frac{1}{r^2}$. Hence $\frac{1}{4}^{\text{th}}$

68. **(d)** $R = \frac{\rho\ell}{A}$; $\ell = \frac{RA}{\rho} = \frac{4.2\times\pi\left(\frac{0.4}{2}\times10^{-3}\right)^2}{4.8\times10^{-8}} = 1.1m$

69. **(c)** Ideal voltmeter should not draw any current flow source hence its resistance = ∞.

Practically infinite resistance is not possible, but ideal voltmeter is possible with the help of potentiometer that you will learn in higher classes.

70. **(d)** $R = \frac{\rho\ell}{A} = \frac{d\rho\ell^2}{m}$; $R \propto \frac{\ell^2}{m}$

$\left[V = A\ell, d = \frac{m}{V} = \frac{m}{A\ell} \Rightarrow A = \frac{m}{d\ell}\right]$

$R_1 : R_2 : R_3 \equiv \frac{9}{1} : \frac{4}{2} : \frac{1}{3} \equiv 9 : 2 : \frac{1}{3} = 27 : 6 : 1$

71. **(c)** Same material → same density, specific resistance as they are material property.

$R = \frac{\rho\ell}{A} = \frac{\rho V}{A^2} = \frac{\rho m}{dA^2}$

$R \propto \frac{1}{A^2} \propto \frac{1}{r^4}$

$\frac{R_A}{R_B} = \frac{r_B^4}{r_A^4} = 2^4 = 16 \Rightarrow R_B = \frac{24}{16} = 1.5\,\Omega$

72. **(b)** $R = \frac{\rho\ell}{A} = \frac{\rho\ell}{\pi r^2}$

$R' = \frac{\rho 2\ell}{\pi(2r)^2} = \frac{R}{4}$

Specific resistance will remain same as it is a material property but remember it depends on temperature.

73. **(a)** Two resistance ($R/2$) will be in parallel, hence $R_{eq} = R/4$

74. **(a)** $V = i \times R$; $R = 60/15 = 4\ \Omega$

75. **(d)** Copper is a conductor while germanium is a semi-conductor. Resistance of temperature decreases with temperature while that of semi-conductor increases hence resistance of copper strip decreases and that of germanium increases.

76. **(d)** 2Ω, 4Ω, 2Ω on right side are in series resultant parallel to 8Ω then in series with 2Ω, 2Ω then in parallel with 8Ω, then in series with 3Ω, 2Ω. Thus, $R_{eq} = 9$ ohm.
$i = 9/9 = 1$ amp flow from battery.
Passing through 3Ω it will divide into equal parts (1/2 amp) in 8Ω (near to cell) and remaining section then again divide into equal parts (1/4 amp) in 8Ω (middle one) and remaining section hence 1/4 amp. passes through 4Ω.

77. **(d)** **78.** **(d)** **79.** **(d)**
80. **(c)** **81.** **(b)** **82.** **(c)** **83.** **(c)**
84. **(b)** **85.** **(a)**

86. **(d)** Fuse wire should be such that it melts immediatley when strong current flows through the circuit. The same is possible if its melting point is low and resistivity is high.

87. **(a)** A heating wire should be such that it produces more heat when current is passed through it and also does not melt. It will be so if it has high specific resistance and high melting point.

88. **(b)** The rate of generation of heat, for a given potential difference is, $P = V^2/R$

89. **(b)** The rate of heat generation
$= I^2R = I^2(\rho\ell/\rho r^2)$.

90. **(a)** Heat produced, $H = V^2\,t/R$ i.e., $H \propto 1/R$
so $H_1/H_2 = R_2/R_1$.

91. **(c)** Power $= V \cdot I = I^2R$

$$i_2 = \sqrt{\frac{\text{Power}}{R}} = \sqrt{\frac{2}{8}} = \sqrt{\frac{1}{4}} = \frac{1}{2}\text{ A}$$

Potential over 8Ω $= Ri_2 = 8 \times \frac{1}{2} = 4V$

This is the potential over parallel branch. So,

$$i_1 = \frac{4}{4} = 1\text{ A}$$

Power of 3Ω $= i_1^2R = 1 \times 1 \times 3 = 3$W

92. **(d)** In house electrical circuits the fuse wire for safety should be of high resistance and low melting point.

93. **(b)** An the three resistors are connected in parallel

$$\frac{1}{R_{eq}} = \frac{1}{R} + \frac{1}{R} + \frac{1}{R} \Rightarrow \frac{1}{R_{eq}} = \frac{3}{R}\ R_{eq} = \frac{R}{3}$$

94. **(d)** Resistance (R) $= \frac{\rho L}{A}$

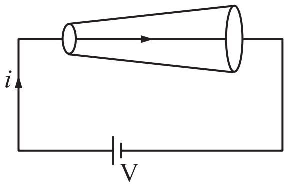
Length is stretched to double
$L' = 2L$

Area $A' = \frac{A}{2}$ $\therefore R' = \frac{\rho \times 2L}{\frac{A}{2}}$

$R' = 4\frac{\rho L}{A} \Rightarrow R' = 4R$

$R = 1\Omega$ $\therefore$ New Resistance, $R' = 4\Omega$

95. **(a)** Here, metallic conductor can be considered as the combination of various conductors connected in series. And in series combination current remains same.



96. **(d)** $\because$ 10Ω and 20Ω are in series = (10 + 20)Ω = 30Ω and 10Ω and 5Ω are in series = (10 + 5)Ω = 15Ω

$$R_{eff} = \frac{30 \times 15}{15 + 30} = \frac{450}{45} = 10\Omega$$

So the total current $I = \frac{V}{R} = \frac{30}{10} = 3$ Ampere

In branch CA current = 1A

In branch CB current = 2A

$\therefore V_C - V_A = 10$ Volt ....(i)

& $V_C - V_B = 20$ Volt ....(ii)

Subtracting (i) from (ii), $V_A - V_B = 10$ volt.

97. **(d)** Let the Diameter of wire $= \frac{d}{5}$

Radius will be $= \frac{r}{5}$

Changed Area will be = A = πr²

$$= \pi\left(\frac{r}{5}\right)^2 = \frac{\pi r^2}{25} \Rightarrow A = \frac{\pi r^2}{25} \Rightarrow 25A = \pi r^2$$

Hence stretched length will be = 25 l

Change resistance (R) = $\frac{\rho \ell}{A} = \frac{\rho(25\ell)}{A/25}$ = 625 R

98. (a) Resistance of the heater be R.

New resistance of heater is R/2

Initial power $= \frac{V^2}{R}$ Final power $= \frac{V^2}{R/2} = 2\frac{V^2}{R}$

$\therefore$ Heat generated is doubled.

99. (d) $R = \frac{\rho\ell}{A}$; New area = nA $\therefore$ New length $= \frac{\ell}{n}$

$\Rightarrow \quad R' = \frac{\rho\ell}{n^2 A} = \frac{R}{n^2}$

100. (b) We know that, $R = \frac{\rho\ell}{A}$

or $R = \frac{\rho\ell^2}{\text{Volume}} \Rightarrow R \propto \ell^2$

According to question $\ell_2 = n\ell_1$

$\frac{R_2}{R_1} = \frac{n^2 l_1^2}{l_1^2}$

or, $\frac{R_2}{R_1} = n^2$

$\Rightarrow \quad R_2 = n^2 R_1$

101. (b) Resistance of 40 W – 200 V, 50 W – 200 V,

100 W – 200 V are respectively.

$R_{40} = \frac{V^2}{P_{40}} = \frac{200 \times 200}{40} = 1000\ \Omega$

$R_{50} = 800\ \Omega$ and $R_{100} = 400\ \Omega$

$I = \frac{600}{1000 + 800 + 400} = \frac{600}{2200} = 0.2727$ A

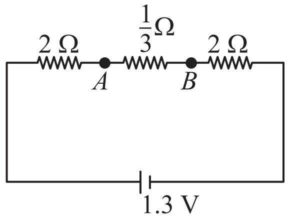
$I_{40} = \frac{P_1}{V} = \frac{40}{200} = 0.2$ A

$I_{50} = \frac{P_2}{V} = \frac{50}{200} = \frac{5}{20} = 0.25$ A

$I_{100} = \frac{P_3}{V} = \frac{100}{200} = 0.5$ A

Clearly, 0.2 A & 0.25 A < 0.27 A hence both 40 W and 50 W bulbs will fuse.

102. (b) After simplifying the given circuit, we get,



$R_{AB} = \frac{1}{3}\Omega$

Then equivalent resistance across the battery,

$R_{eq} = 2 + \frac{1}{3} + 2 = \frac{13}{3}\Omega$

So current in circuit, $I = \frac{V}{R_{eq}} \Rightarrow \frac{1.3}{13} \times 3$ amp

$I = \frac{3}{10}$ amp

Power dissipated across arm AB,

$P_{AB} = I^2 \times R_{AB} = \left(\frac{3}{10}\right)^2 \times \frac{1}{3}$

$P_{AB} = \frac{3}{100} = 0.03$ Watt

Total power dissipated in circuit,

$P_{ckt} = I^2 \times R_{eq} = \left(\frac{3}{10}\right)^2 \times \frac{13}{3}$

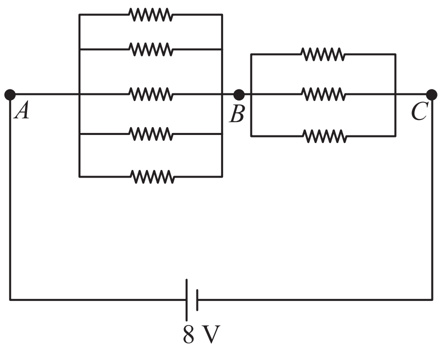
$P_{ckt} = \frac{39}{100} = 0.39$ watt

Ratio of power across A and B to total power = Ratio of work done across A and B to total circuit

$\because \quad W = P \times t$

So, $\frac{P_{AB}}{P_{ckt}} = \frac{W_{AB}}{W_{ckt}} = \frac{0.03}{0.39} = \frac{1}{13}$

103. (b) After simplifying the given circuit, we get



Resistance between arm AB, $R_{\text{net } AB} = \frac{1}{5}k\Omega = \frac{1000}{5}\Omega$

Resistance between arm BC, $R_{\text{net }BC} = \frac{1}{3}k\Omega = \frac{1000}{3}\Omega$

So, $R_{\text{net}} = R_{\text{net }AB} + R_{\text{net }BC}$

We get, $R_{\text{net}} = \frac{1000}{5} + \frac{1000}{3}$

$R_{\text{net}} = \frac{8000}{15}\Omega$

According to ohm's law, $V = IR$

$I = \frac{8 \times 15}{8000} = 15mA$

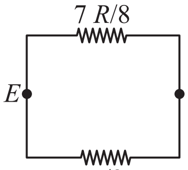
104. (b) Here $R_{DA} = R_{AB} = R_{BC} = R/4$

and $R_{DE} = R_{EC} = R/8$

Now R_{ED}, R_{DA}, R_{AB}, R_{BC} are in series.

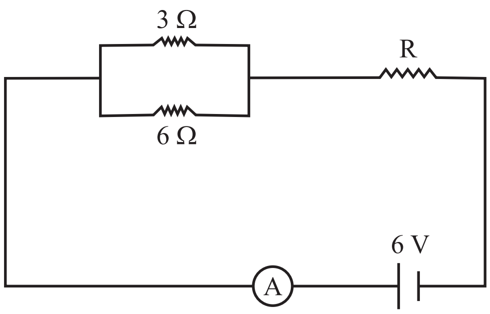
$\therefore R_s = \frac{R}{8} + \frac{R}{4} + \frac{R}{4} + \frac{R}{4} = \frac{R + 2R + 2R + 2R}{8} = \frac{7R}{8}$

$\therefore \quad R_{eq} = \frac{\left(\frac{7R}{8}\right)\left(\frac{R}{8}\right)}{R} = \frac{7R}{64}$



105. (d) Fuse is an safety device that operates to provide over current protection of an electrical circuit. A fuse is mainly a metal wire that melts when too much current flows through it due to low melting point and protects electric appliances.

106. (a) I = 2 A



Two resistance are in parallel,

$\frac{1}{R_1} = \frac{1}{3} + \frac{1}{6} = \frac{2+1}{6} = \frac{3}{6} = \frac{1}{2}$

$\therefore R_1 = 2\Omega$ ...(i)

$R_{eq} = \frac{\text{Voltage}}{\text{Current}}$

$R_{eq} = \frac{6\text{ V}}{2\text{ A}} = 3\ \Omega$ ...(ii)

where unknown resistance R, from (i) and (ii)

R = 3 Ω – 2 Ω

R = 1 Ω

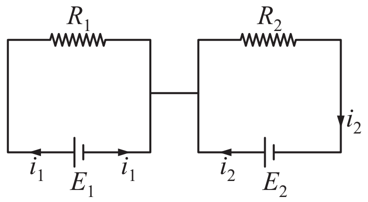
107. (c) **Ammeter :** In series connection, the same current flows through all the components. It aims at measuring the current flowing through the circuit and hence, it is connected in series.

Voltmeter : A voltmeter measures voltage change between two points in a circuit. So we have to place the voltmeter in parallel with the circuit component.

108. (d) **109. (d)**

110. (a) In parallel combination, total power $P = P_1 + P_2$

111. (d) Current leaving the cell must be equal to current going into the cell.

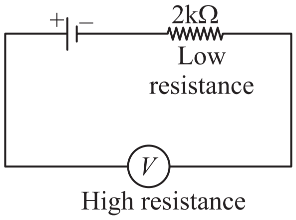


For any value of E or R current going from first loop to second loop must be zero.

Hence, there is no current through the wire 1.

112. (c) The resistance of ammeter is very low and resistance of voltmeter is very high. When ammeter is put in parallel to 8kΩ resistor, nearly whole of current goes through the ammeter.

The equivalent circuit is as follows



Hence, maximum potential drop occurs in the voltmeter.

So, reading of voltmeter is nearly 6 V.

113. (c) Power delivered by the UPS battery is 1kVA i.e. 1000 V.A = 1000W

When all the laptops connected directly to UPS then total power requirement

90 × 10 = 900W,

So battery (UPS) can provide power to all laptops.

If all laptops are used for 5 hours, then cost of electricity consumed as the cost of electricity is ₹5.00 per unit.

$$= \frac{900 \times 5 \times 3600}{3.6 \times 10^6} \times 5 = 22.5$$

114. (c) Resistance, $R = \frac{\rho \ell}{A}$

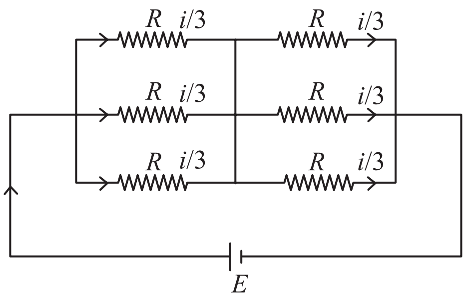
$$R = \rho \frac{\ell}{A} \times \frac{\ell}{\ell} = \frac{\rho \ell^2}{V}$$

[∵ Volume (V) = Aℓ]

Since resistivity and volume remains constant therefore % change in resistance

$$\frac{\Delta R}{R} = \frac{2\Delta \ell}{\ell} = 2 \times (0.5) = 1\%$$

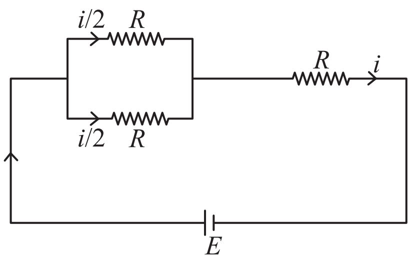
115. (b) When all bulbs are glowing



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

Power $(P_i) = \frac{E^2}{R_{eq}} = \frac{3E^2}{2R}$ …(i)

When two from section A and one from section B are glowing, then



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

Power $(P_f) = \frac{2E^2}{3R}$ …(ii)

Dividing equation (i) by (ii) we get

$$\frac{P_i}{P_f} = \frac{3E^2 3R}{2R\, 2E^2} = 9 : 4$$

116. (a) When the lamps are connected in parallel, then potential difference V across each lamp will be same and will be equal to potential necessary for full brightness of each bulb. Because illumination produced by a lamp is proportional to electric power consumed in it, and power consumed,

$$P_1 = \frac{V^2}{R_1} < \frac{V^2}{R_2} = P_2$$

Hence, illumination produced by 2nd bulb will be higher than produced by lst bulb, i.e., bulb having lower resistance will shine more brightly.

117. (b) When R_1 burns out, then power is dissipated in R_2 only. Because internal resistance is quite low in lighting circuit, potential difference is still equal to V, hence, power dissipated in 2nd lamp, i.e.,

$$\frac{V^2}{R_2} < \left(\frac{V^2}{R_1} + \frac{V^2}{R_2}\right)$$

i.e., net power consumed initially. In other words, net illumination will now decrease.

118. (b) When two lamps are connected in series, the potential difference across each lamp will be different but current I flowing through each lamp will be same.

Hence, $P_1 = I^2 R_1 > I^2 R_2 = P_2$

i.e., illumination produced by lst lamp will be higher as compared to that produced by 2nd lamp, i.e., lamp having higher resistance will glow more brightly.

119. (b) When lamp of resistance R_2 burns out and only lamp of resistance R_1 is connected in the circuit then current flowing the circuit will change. Let new current be I'. Because potential difference still remains same (due to low internal resistance), hence

$I' R_1 = I (R_1 + R_2)$

or $I' = \frac{I(R_1 + R_2)}{R_1}$

If P' is the power consumed, then

$$P' = I'^2 R_1 = I^2 \frac{(R_1 + R_2)(R_1 + R_2)}{R_1}$$

When both the lamps were present then total power consumed was given by:

$P_S = P_1 + P_2 = I^2 (R_1 + R_2)$, *i.e.,* $P' > P_S$

i.e., illumination gets increased when only one bulb is used.

120. (a) If a water pipe is given bend at some points, then it definitely reduces the flow of water in the pipe but this is not true in case of an electric current flowing in a conductor because electric current is established in a conductor due to drift motion of electrons in it along the line of the potential gradient. Hence, illumination is not affected due to bending along the length of supply wires.

121. (b) $P = VI = V^2/R = I^2R$

122. (d) $P = \dfrac{V^2}{R} \Rightarrow R = \dfrac{V^2}{P} = \dfrac{220 \times 220}{100} = 484\ \Omega$

$$P = \frac{V^2}{R} = \frac{110 \times 110}{484} = 25W$$

123. (c) $R_S = R_1 + R_2 = R + R = 2R$

$$\frac{1}{R_P} = \frac{1}{R_1} + \frac{1}{R_2} = \frac{1}{R} + \frac{1}{R} = \frac{2}{R}$$

$R_P = R/2$

$$\frac{H_1}{H_2} = \frac{V^2\ R_P}{R_S\ V^2} = \frac{R_P}{R_S} = \frac{R}{2 \times 2R} = \frac{1}{4} = 1:4.$$

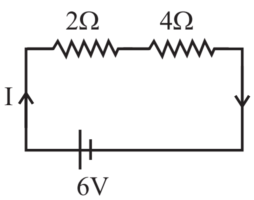
124. (c) The bulb with the highest wattage glows with maximum brightness. Brightness of bulb *B* (100 W) is maximum.

Correct order of brightness will be,

Bulb of 100 W > Bulb of 60 W > Bulb of 40 W.

125. (c) Given, resistors, $R_1 = 2\Omega$ and $R_2 = 4\Omega$

Voltgage, $V = 6$ V



Equivalent Resistance,

$= R_1 + R_2 = 2 + 4 = 6\Omega$ [Series combination]

Current, $I = \dfrac{V}{R} = \dfrac{6}{6} = 1A.$

Heat dissipated in 4Ω Resistor

$= I^2Rt = 1 \times 4 \times 5 = 20$ J

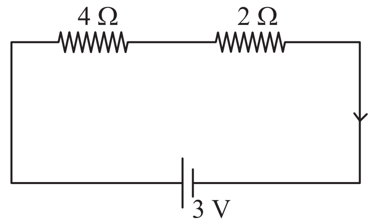
[$I = 1A, R = 4\Omega, t = 5$ sec.]

126. (b) Equivalent resistance of 3Ω and 6Ω $= \dfrac{3 \times 6}{3+6} = 2\Omega$

as they are in parallel they have same p.d.

$$i = \frac{3}{6} = \frac{1}{2}$$

P.D. across $3\Omega = \dfrac{1}{2} \times 3 = 1.5$ volt



127. (b) **128. (a)**

129. (d) Given : $R_1 = 12\Omega$, $R_2 = 3.0\Omega$, $R_3 = 5.0\Omega$, $R_4 = 4.0\Omega$, All four resistors are in series combination, so

$R_s = R_1 + R_2 + R_3 + R_4$

$= 12\Omega + 3.0\Omega + 5.0\Omega + 4.0\Omega = 24\Omega$

130. (c) The current through all resistors in series is the same

$$I = \frac{V}{R} = \frac{V}{R_s} = \frac{12V}{24\Omega} = 0.50\ A$$

131. (b) Potential drop across, 12Ω resistor

$V = IR = 12\Omega\ (0.5A)$

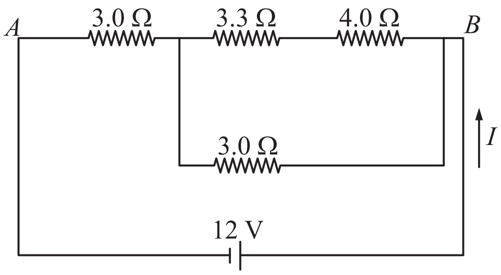
or $V = 6V$

132. (b) Here we have a variety of series-parallel combinations.

We follow the general procedures outlined in the text.

The 10 Ω and the 5.0 Ω are in parallel

$$R_{p_1} = \frac{(10\Omega)\ (5.0\Omega)}{10\Omega + 5.0\Omega} = 3.33\ \Omega$$

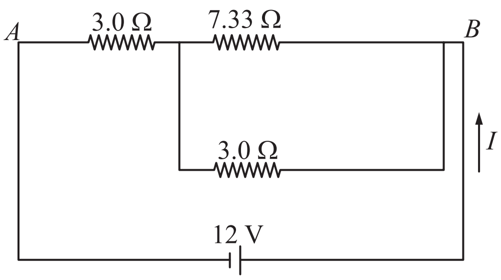


(i) The circuit reduces to figure (a)

Now the 3.33 Ω and the 4.0 Ω are in series.

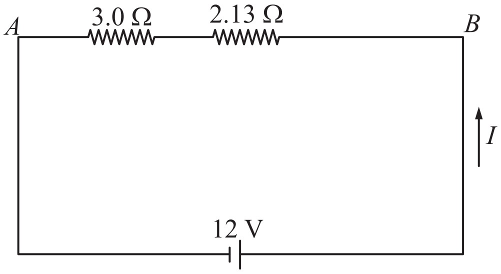
$$R_{s_1} = 3.33\Omega + 4.0\Omega = 7.33\Omega$$

The circuit reduces to figure (ii)



(ii) The 7.33 Ω and the 3.0 Ω are in parallel.

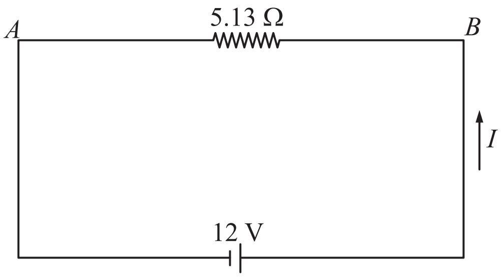
$$R_{p_2} = \frac{(7.33\Omega)(3.0\Omega)}{7.33\Omega + 3.0\Omega} = 2.13\Omega$$



(iii) The circuit reduces to figure (iii).

Finally, the 2.13 Ω and the 3.0 Ω are in series.

$$R = R_{s_2} = 2.13\Omega + 3.0\Omega = 5.13\,\Omega = 5.1\Omega$$



(iv) The circuit reduces to figure (iv).

133. (a) From Ohm's law, $I = \frac{V}{R} = \frac{12V}{5.13\Omega} = 2.33A = 2.3A$

134. (d) To find the current through the 4.0 ohm resistor, we need to expand the combinations.

In figure (iii), the current through the 2.13 Ω and 3.0 Ω is the same as the total current, 2.33 A.

The voltage across the 2.13 Ω is then $V_{2.13}$ = (2.13 Ω) (2.33 A) = 4.96 V.

In figure (ii), the voltage across the 7.33 Ω and 3.0 Ω is the same as that across the 2.13 Ω, 4.96V.

So, the current through the 7.33 Ω is

$$I_{7.33} = \frac{4.96V}{7.33\Omega} = 0.677A$$

In figure (i), the current through the 3.33 Ω and the 4.0 Ω is the same as the current through the 7.33 Ω

Therefore, $I_{4.0}$ = 0.68 A.

135. (a) E.m.f. of the battery = 2V

Effective resistance of the parallel resistors is given by R_1.

$$\frac{1}{R_1} = \frac{1}{6} + \frac{1}{2} = \frac{1+3}{6} = \frac{4}{6} = \frac{2}{3} \quad \Rightarrow \quad R_1 = \frac{3}{2} = 1.5\,\Omega$$

Total resistance of the circuit, R = 1.5 + 0.5 = 2Ω

136. (a) Main current $I = \frac{V}{R} = \frac{2}{2} = 1A$

Current flowing through 0.5Ω resistor = 1A

137. (d) P.D. across the junctions :

$V_1 = IR_1 = 1 \times 1.5 = 1.5V$

Hence current I_1, flowing through 6Ω resistor

$$I_1 = \frac{V_1}{6} = \frac{1.5}{6} = 0.25\,A$$

138. (c)

139. (c) Alloys are used in electrical heating device because they have high resistivity or resistance as compared to pure metals and high melting point.

140. (c) It is clear that in a battery circuit, the point of lowest potential is the negative terminal of battery.

and current flows from higher potential to lower potential.

141. (c) It is common error to say that V = Ri is a statement of Ohm's law. The essence of Ohm's law is that the value of R is independent of the value of V. The equation $V = Ri$ is used for finding resistance of all conducting devices, whether they obey Ohm's law or not.

142. (d) (A) will read zero but (V) will read E

143. (d) ρ is the characteristic of the material of resistors. It does not depend on the length and cross-sectional area of resistors. But R depends on the length and the cross-sectional are of the resistor.

So, R_1 may be greater than R_2 even when $\rho_1 \le \rho_2$.

144. (a) **145. (d)**

146. (c) Resistivity is a material property.

147. (c) $\rho = \rho_0(1 + \alpha\Delta T)$

148. (b) Glow = Power (P) = I^2R

$$\therefore \quad \frac{dP}{P} = 2\left(\frac{dI}{I}\right) = 2 \times 0.5 = 1\%$$

149. (a) Power loss = $i^2R = \left(\frac{P}{V}\right)^2 R$

[P = Transmitted power]

150. (b) $P = \frac{V^2}{R}$; $\quad R \propto \frac{1}{P}$ (same rated voltage)

151. (c) Here, $P = \frac{E^2}{R}$, so $P \propto R$ only when I is constant.

Here I increases as R is decreased. Hence the reason is wrong.

152. (A) → (q); (B) → (p); (C) → (s); (D) → (r)

153. (A) → q; (B) → r; (C) → p; (D) → s

154. electric current **155.** zero

156. series

157. potential difference **158.** resistivity

159. ampere **160.** Resistance

161. ohm (Ω)

162. directly proportional, temperature

163. length, area of cross-section, resistivity

164. joule **165.** Scalar

166. decreases **167.** ohm-meter

168. electric current

169. 1 Ω **170.** inversely.

171. power, energy **172.** ampere, hour

173. resistance, melting point **174.** low, lead, tin, melts

175. series, live **176.** separation

177. voltmeter **178.** $V \times I \times t$

179. watt (W) **180.** 1 V

181. 3,600,000 J **182.** Tungsten

183. voltage, current **184.** electric power

185. False **186.** True **187.** False

188. True **189.** True **190.** True

191. False **192.** False **193.** True

194. True **195.** False **196.** False

197. True **198.** True **199.** True

200. True **201.** False **202.** False