ELECTRICITY

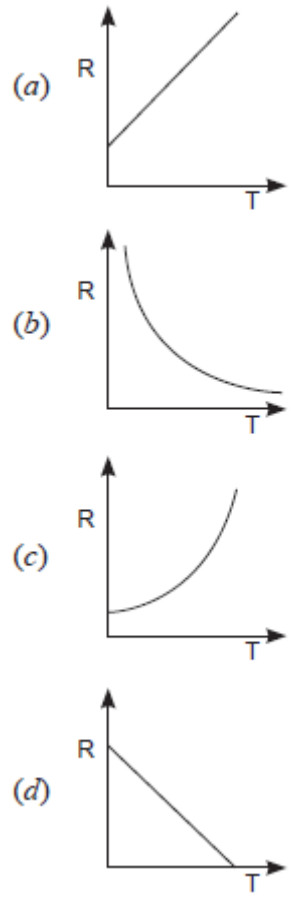
1. **A wire of length l, made of material resistivity r is cut into two equal parts. The resistivity of the two parts is equal to,**

(a) ρ (b) $\frac{\rho}{2}$

(c) 2ρ (d) 4ρ

Ans:(a) Resistivity of the material depends only on the nature of material not dimensions.

2. **The temperature of a conductor is increased. The graph best showing the variation of its resistance is**



Ans:(a) Resistance is directly proportional to temperature of the conductor.

3. **A battery of 10 volt carries 20,000 C of charge through a resistance of 20 Ω. The work done in 10 seconds is**

(a) 2×10^3 joule (b) 2×10^5 joule

(c) 2×10^4 joule (d) 2×10^2 joule

Ans:(b) $W = qV = 20000 \times 10 = 2,00,000 = 2 \times 10^5$ J

4. **A boy records that 4000 joule of work is required to transfer 10 coulomb of charge between two points of a resistor of 50 Ω. The current passing through it is**

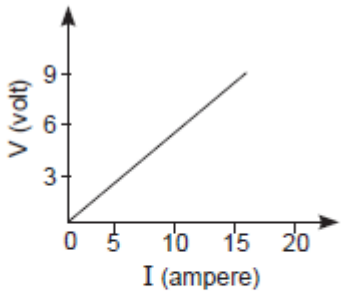
(a) 2 A (b) 4 A

(c) 8 A (d) 16 A

Ans:(c) Work done in transferring the charge W = qV = qIR ….. (V = IR)

$$\Rightarrow \quad I = \frac{W}{qR} = \frac{4000}{10 \times 50} = 8A$$

5. The resistance whose V – I graph is given below is



(a) $\frac{5}{3}\ \Omega$ (b) $\frac{3}{5}\ \Omega$

(c) $\frac{5}{2}\ \Omega$ (d) $\frac{2}{5}\ \Omega$

Ans:(b) Resistance = slope line of V-I graph = $\frac{9-0}{15-0} = \frac{9}{15} = \frac{3}{5}\ \Omega.$

6. **To get 2 Ω resistance using only 6 Ω resistors, the number of them required is**

(a) 2 (b) 3

(c) 4 (d) 6

Ans:(b) Three resistors of 2 Ω is required to get 6 Ω because resultant is more than individual so they all must be connected in series.

7. Two wires of same length and area made of two materials of resistivity ρ_1 and ρ_2 are connected in series to a source of potential V. The equivalent resistivity for the same area is

(a) $\rho_1 + \rho_2$ (b) $\frac{\rho_1\rho_2}{\rho_1+\rho_2}$

(c) $\frac{(\rho_1+\rho_2)}{\rho_1\rho_2}$ (d) $\left(\frac{|\rho_1+\rho_2|}{2}\right)$

Ans: a

8. **Two devices are connected between two points say A and B in parallel. The physical quantity that will remain the same between the two points is**

(a) current (b) voltage

(c) resistance (d) None of these

Ans:(b) In parallel combination voltage remains same across two points.

9. **The least resistance obtained by using 2 Ω, 4 Ω, 1 Ω and 100 Ω is**

(a) < 100 Ω (b) < 4 Ω

(c) < 1 Ω (d) > 2 Ω

Ans:(c) In parallel combination, the equivalent resistance is smaller than the least resistance used in the circuit.

10. Two wires of same length and area, made of two materials of resistivity and are connected in parallel V to a source of potential. The equivalent resistivity for the same length and area is

$(a)\ \rho_1 + \rho_2$ $(b)\ \dfrac{\rho_1\rho_2}{\rho_1+\rho_2}$

$(c)\ \dfrac{(\rho_1+\rho_2)}{\rho_1\rho_2}$ $(d)\ |\rho_1 - \rho_2|$

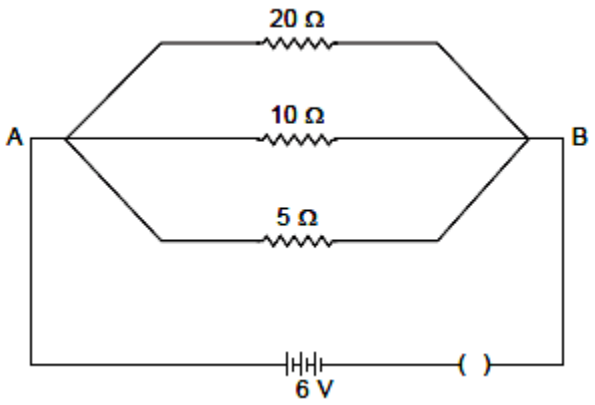
Ans:(b) Equivalent resistance in parallel combination is $\dfrac{1}{R_P} = \dfrac{1}{R_1} + \dfrac{1}{R_2}$

For the same length and area of cross-section, $R \propto \rho$ (resistivity)

$$\therefore \quad \frac{1}{\rho_p} = \frac{1}{\rho_2} = \frac{\rho_1+\rho_2}{\rho_1\rho_2}$$

$$\text{or} \quad \rho_p = \frac{\rho_1\rho_2}{\rho_1+\rho_2}$$

11. Calculate the current flows through the 10 Ω resistor in the following circuit.



(a) 1.2 A (b) 0.6 A

(c) 0.2 A (d) 2.0 A

Ans:(b) In parallel, potential difference across each resistor will remain same. So, current through 10 Ω resistor

$$I = \frac{V}{R} = \frac{6}{10} = 0.6\ A$$

12. **Two resistors are connected in series gives an equivalent resistance of 10 Ω. When connected in parallel, gives 2.4 Ω. Then the individual resistance are**

(a) each of 5 Ω (b) 6 Ω and 4 Ω

(c) 7 Ω and 4 Ω (d) 8 Ω and 2 Ω

Ans:

(b) In series, $R_s = R_1 + R_2 = 10\ \Omega$

In parallel, $\frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_1} = \frac{1}{2.4} = \frac{10}{24} = \frac{5}{12}$

13. If R_1 and R_2 be the resistance of the filament of 40 W and 60 W respectively operating 220 V, then

(a) $R_1 < R_2$ (b) $R_2 < R_1$

(c) $R_1 = R_2$ (d) $R_1 \geq R_2$

Ans:

(b) Using power, $P = \frac{V^2}{R}$ or $R = \frac{V^2}{P}$

For the same voltage, $R \propto \frac{1}{P}$

More the power, lesser the resistance.

Accordingly, $R_2 < R_1$

14. **The resistance of hot filament of the bulb is about 10 times the cold resistance. What will be the resistance of 100 W-220 V lamp, when not in use?**

(a) 48 Ω (b) 400 Ω

(c) 484 Ω (d) 48.4 Ω

Ans:

(c) $R = \frac{V^2}{P} = \frac{220 \times 220}{100} = 484\ \Omega$

15. If P and V are the power and potential of device, the power consumed with a supply potential V_1 is

$(a)\ \frac{V_1^2}{V^2}P$ $(b)\ \frac{V^2}{V_1^2}P$

$(c)\ \frac{V}{V_1}P$ $(d)\ \frac{V_1}{V}P$

Ans:

$(c)\ R = \frac{V^2}{P}$ and $P_1 = \frac{V_1^2}{R} = \frac{V_1^2}{V^2}P$

16. A coil in the heater consume power P on passing current. If it is cut into halves and joined in parallel, it will consume power

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

Ans:

(d) Original power consumed, $P = \frac{V^2}{R}$

When used in parallel

$$\frac{1}{R_P} = \frac{1}{R_1} + \frac{1}{R_2} = \frac{1}{\frac{R}{2}} + \frac{1}{\frac{R}{2}} = \frac{4}{R}$$

$$R_P = \frac{R}{4}$$

$\therefore$ New power consumed when two halves in parallel

$$P' = \frac{V^2}{R_P} = \frac{V^2}{\frac{R}{4}} = 4\frac{V^2}{R} = 4\ \text{P}$$

17. **A fuse wire repeatedly gets burnt when used with a good heater. It is advised to use a fuse wire of**

(a) more length (b) less radius

(c) less length (d) more radius

Ans:(d) In order to get the working of heater properly, fused wire of higher rating must be used.

18. **A cooler of 1500 W, 200 volt and a fan of 500 W, 200 volt are to be used from a household supply. The rating of fuse to be used is**

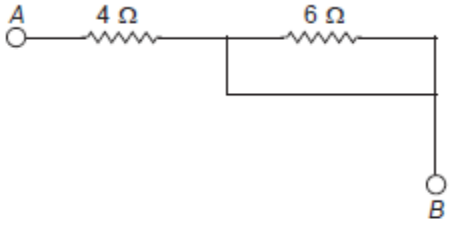
(a) 2.5 A (b) 5.0 A

(c) 7.5 A (d) 10 A

Ans:(d) Total power used, $P = P_1 + P_2 = 1500 + 500 = 2000$ W. Current drawn from the supply,

$$I = \frac{P}{V} = \frac{2000}{200} \text{ 10 A}$$

19. The effective resistance between A and B is



(*a*) 4 Ω (*b*) 6 Ω

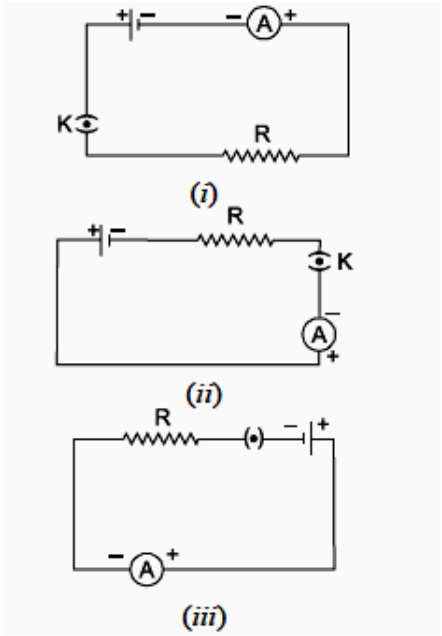
(*c*) May be 10 Ω (*d*) Must be 10 Ω

Ans:(a) 6 Ω is shorted so effective resistance is 4 Ω.

20. **A cell, a resistor, a key and an ammeter are arranged as shown in the circuit diagrams. The current recorded in the ammeter will be**

(a) maximum in (i) (b) maximum in (ii)

(c) maximum in (iii) (d) same in all the cases



Ans:(d) Ammeter is always connected in series with in the circuit. The reading is independent from its location.

21. **In the following questions, the Assertion and Reason have been put forward. Read the statements carefully and choose the correct alternative from the following:**
(a) Both the Assertion and the Reason are correct and the Reason is the correct explanation of the Assertion.
(b) The Assertion and the Reason are correct but the Reason is not the correct explanation of the Assertion.
(c) Assertion is true but the Reason is false.
(d) The statement of the Assertion is false but the Reason is true.

Assertion: In an open circuit, the current passes from one terminal of the electric cell to another.
Reason: Generally, the metal disc of a cell acts as a positive terminal.

Ans:(d) The statement of the Assertion is false but the Reason is true.

22. In the following questions, the Assertion and Reason have been put forward. Read the statements carefully and choose the correct alternative from the following:
(a) Both the Assertion and the Reason are correct and the Reason is the correct explanation of the Assertion.
(b) The Assertion and the Reason are correct but the Reason is not the correct explanation of the Assertion.
(c) Assertion is true but the Reason is false.
(d) The statement of the Assertion is false but the Reason is true.

Assertion: The statement of Ohm's law is V = IR
Reason: V = IR is the equation which defines resistance.

Ans:(c) Assertion is true but the Reason is false.

23. Presence of argon prolongs the life of _____.

Ans: Filament of electric bulb

24. Work done on unit charge is called as _____.

Ans: Potential difference

25. Two resistors are in parallel when they have _____ common points.

Ans: One

26. 746 watts make _____ horse power.

Ans: One

27. Rheostat used in series in a circuit can make a bulb to glow with varying brightness. [True/False]

Ans: True

28. One common point and no sharing devices for that point are the conditions to be satisfied for two resistors to be in series. [True/False]

Ans: True

29. When bulbs are connected in series, the lower power bulb glows brighter. [True/False]

Ans: True

30. **Nichrome is used for making standard resistances as it readily varies its resistance with temperature**. **[True/False]**

Ans: False

31. The equivalent resistance between two diametrically opposite points as a wire of 10 Ω resistance is made a circle is 2.5 Ω. [True/False]

Ans: True

32. Devices of higher power used at home have lower resistance. [True/False]

Ans: True

33. 12 V means the work done to carry a unit charge from one point to another is 12 joule. [True/False]

Ans: True

34. A lamp draws a current of 0.5 A when it is connected to a 60 V source. What is the resistance of the lamp?

Ans: From Ohm's law, I = V / R we get,

R = V / I = 60/ 0.5 = 120 Ω

35. A torch bulb is rated at 1.5 V, 500 mA. Find its resistance.

Ans: From Ohm's law, I = V / R we get,

$R = V / I = 1.5/ 500 \times 10^{-3} = 3\ \Omega$

36. Resistance of an incandescent filament of a lamp is comparatively much more than that when it is at room temperature. Why?

Ans: When bulb is switched on (i.e., incandescent state), the temperature of filament rises. As the temperature increases, the resistance of conductor also increases.

37. Why closed path is required for the flow of current?

Ans: It makes possible to move the electrons in a particular direction, so closed path is necessary for the flow of current.

38. Why is magnanin used for making standard resistors?

Ans: Magnanin being an alloy has a low temperature coefficient of resistance.

39. How will the resistivity of a conductor change when its length is tripled by stretching it?

Ans: The resistivity of a metallic conductor does not depend on the length of the wire, so it will remain same.

40. The radius of conducting wire is doubled. What will be the ratio of its new specific resistance to the old one?

Ans: 1:1, as it depends on the nature of material only.

41. Write S.I. unit of resistivity.

Ans: Ohm-metre.

42. Why is a series arrangement not used for connecting domestic electrical appliances in a circuit?

Ans: If any one stops working due to some reason, other will also stop working.

43. Which combination is used for connecting the device in the circuit to measure the potential difference across two points?

Ans: Parallel combination.

44. Why the bulb gets fused, if it is operated at a higher potential than its power rating?

Ans: More heat will be produced when bulb is operated at higher potential than its power rating as H = . So, bulb gets fused.

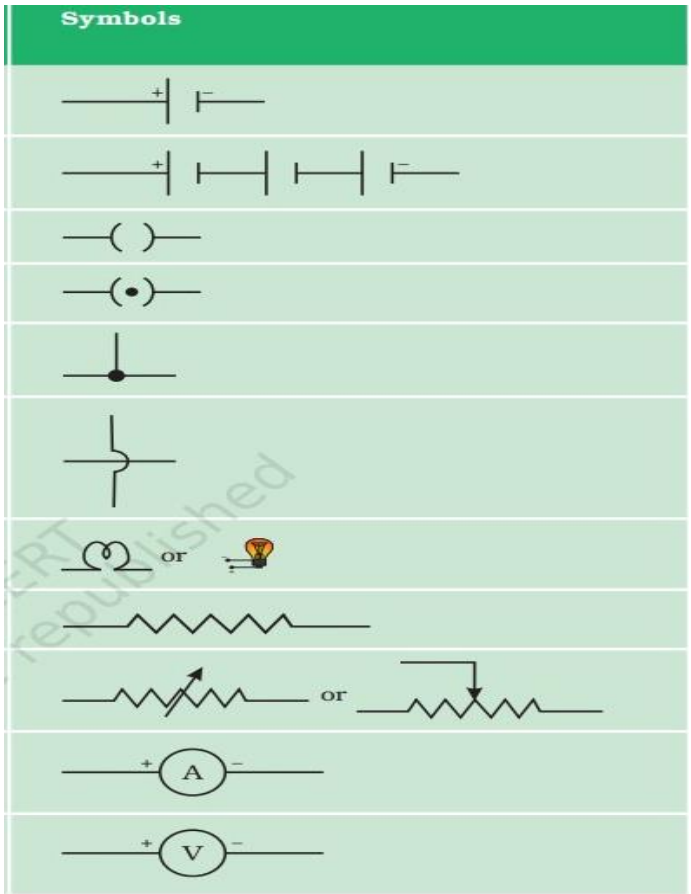
45. How are bulbs connected in a fairy light circuit used for decoration of buildings in festivals?

Ans: Series combination.

46. (a) Identify the various elements of the circuit shown below:

(b) What does the bigger line of element 1 represent?

Ans:(a) Various element of the circuit are



1 An electric cell

2 A battery or a combination of cells

3 Plug key or switch (open)

4 Plug key or switch (closed)
5 A wire joint
6 Wires crossing without joining
7 Electric bulb or
8 A resistor of resistance R
9 Variable resistance or rheostat or
10 Ammeter
11 Voltmeter
(b) Bigger line of element 1 represents positive terminal of the cell.

47. Series arrangements are not used for domestic circuits. List any three reasons.

Ans: Series arrangements are not used for domestic circuit because
(i) The electrical appliances need current of widely different values to operate properly.
(ii) In series arrangement, when one component fails, the circuit is broken and none of the components works.
(iii) All electrical appliances work at a constant voltage. But in series circuit, the current is constant throughout the electric circuit and potential is different across the different components. So, series arrangement is not suitable for domestic circuits.

48. Two resistors 3 Ω and unknown resistor are connected in a series across a 12 V battery. If the voltage drop across the unknown resistor is 6 V, find
(a) potential across 3 Ω resistance (b) the current through unknown resistor 'R'
(c) equivalent resistance of the circuit.

Ans:(a) Same current will flow through each resistor of series combination, the potential drop across both 3 Ω resistor will be same ($V_1 = V_2$). In series, applied potential,

(b) Current through 3 Ω resistance

So, current through unknown resistance R is 1 A. (c) Unknown resistance 3

49. An electric geyser rated 1500 W, 250 V is connected to a 250 V line mains.
Calculate:
(i) the electric current drawn by it.
(ii) energy consumed by it in 50 hours.
(iii) cost of energy consumed if each unit costs ₹ 6.00.

Ans: Given: P = 1500 W, V = 250 V
(i) Current drawn, I =

(ii) Electric energy consumed by geyser in 50 hours = Power × time
= 1500 × 50 = 75000 Wh = 75 kWh
Since
1 kWh = 1 unit
So, energy consumed = 75 units.

(iii) Cost of one unit = ₹ 6.00
∴ Cost of 75 units = ₹ 75 × 6.00 = ₹ 450.00

50. State Ohm's law. Write the necessary conditions for its validity. How is this law verified experimentally? What will be the nature of graph between potential difference and current for a conductor? Name the physical quantity that can be obtained from this graph.

Ans:

Ohm's law: When the physical conditions such as temperature etc. remain same, the current flowing through the conductor is directly proportional to the potential difference applied across the ends of the conductor, i.e.,
$I \propto V$ or $V \propto I$

where R is constant of proportionality and is called resistance of the wire.

Necessary condition for validity of Ohm's law: Physical condition such as temperature of the conductor remains same.
Experimental verification: Refer to NCERT Activity-1 of this chapter.
Nature of V – I graph is a straight line passing through the origin of the graph and inclined to *x*-axis as shown.
The slope of V – I graph gives the value of resistance of the conductor at the given temperature.

51. (a) Though same current flows through the electric line wires and the filament of bulb, yet only the filament glows. Why?
(b) The temperature of the filament of bulb is 2700 °C when it glows. Why does it not get burnt up at such high temperature?
(c) The filament of an electric lamp, which draws a current of 0.25 A is used for four hours. Calculate the amount of charge flowing through the circuit.
(d) An electric iron is rated 2 kW at 220 V. Calculate the capacity of the fuse that should be used for the electric iron.

Ans:(a) Electric line wires offer extremely low resistance to the flow of current, so they do not glow because negligible heat is produced in it.
The filament of bulb glows because it becomes red hot due to large amount of heat produced, as it offers high resistance to the flow of current through it.
(b) The filament of bulb when it glows at 2700 °C does not gets burnt because the tungsten metal of filament has
(i) a very high melting point (of 3380 °C) and
(ii) a high resistivity.
(c) Given: $I = 0.25$ A, $t = 4\ h = 4 \times 60 \times 60$ sec.
So, amount of charge flowing the filament of electric lamp

$q = It = 0.25 \times 4 \times 60 \times 60 = 3600$ C

(d) Given $P = 2$ kW $= 2000$ W

$V = 220$ V

Using, $P = VI$

$2000 = 220 \times I$

So, the capacity of the fuse that should be used for the electric iron is 10