INDIAN SCHOOL AL WADI AL KABIR		
Class: X	**DEPARTMENT OF SCIENCE: 2025-26** **SUBJECT: PHYSICS**	**DATE: 24/08/2025**
WORKSHEET NO: 4 **(WITH ANSWERS)**	**TOPIC: ELECTRICITY**	**A4 FILE FORMAT** **(PORTFOLIO)**
CLASS & SEC:	**NAME OF THE STUDENT:**	**ROLL NO.**

OBJECTIVE TYPE QUESTIONS (1 MARK)

1) What is the amount of current flowing through an electric press, if the amount of charge passing through a conductor in 10 minutes is 300 C?

   a) 30 A

   b) 0.3 A

   c) 0.5 A

   d) 5 A

2) A wire of length 'l', made of material resistivity ρ is cut into two equal parts. The resistivity of the two parts are equal to,

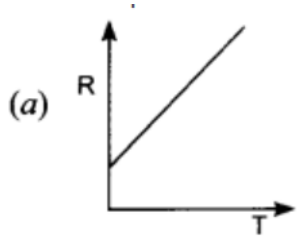
   a) ρ

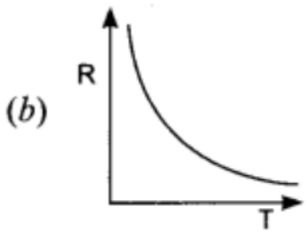
   b) ρ/2

   c) 2 ρ

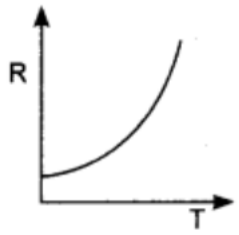
   d) 4 ρ

3) The temperature of a conductor is increased. The graph best showing the variation of its resistance is

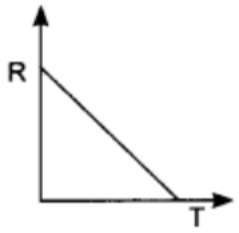




(c)



(d)

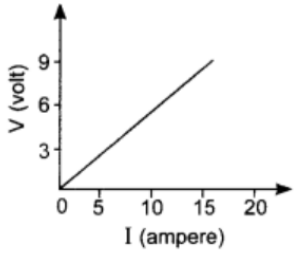


4) A fuse wire is inserted in which wire?
   a) Live wire
   b) In the neutral wire
   c) In the earth wire
   d) May be connected in any line

5) 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

6) 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

7) The resistance whose V-I graph is given below is



   a) 5/3 Ω
   b) 3/5 Ω
   c) 2/5 Ω
   d) 5/2 Ω

8) To get 2 Ω resistance using only 6 Ω resistors, the number of them required is
   a) 2
   b) 3
   c) 4
   d) 6

9) If the current flowing through a fixed resistor is halved, the heat produced in it will become:
   a) One-fourth
   b) One-half
   c) Double
   d) Four times

10) 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) $R_1 \geq R_2$

ASSERTION AND REASONING TYPE OF QUESTIONS (1 MARK):

DIRECTION: In the following questions, a statement of assertion (A) is followed by a statement of reason (R). Mark the correct choice as:

a) Both A and R are true, and R is the correct explanation of A.
b) Both A and R are true, and R is not the correct explanation of A.
c) A is true but R is false.
d) A is false but R is true

11) **Assertion (A):** Circuit with 15 A current rating is used for appliances such as geysers and air coolers.
   Reason (R): Appliances with metallic body are connected to an earth wire with low resistance.

12) **Assertion (A):** Longer wires have greater resistance and the smaller wires have lesser resistance.
   Reason (R): Resistance is inversely proportional to the length of the wire.

13) **Assertion (A):** Bending a wire does not affect electrical resistance.
   Reason (R): Resistance of a wire is proportional to resistivity of material.

14) **Assertion (A):** Alloys are commonly used in electrical heating devices, like electrical iron, toasters etc.
   Reason (R): Alloys do not oxidize (burn) readily at high temperatures.

15) **Assertion (A):** Fuse wire must have high resistance and low melting point.
   Reason (R): Fuse is used for small current flow only.

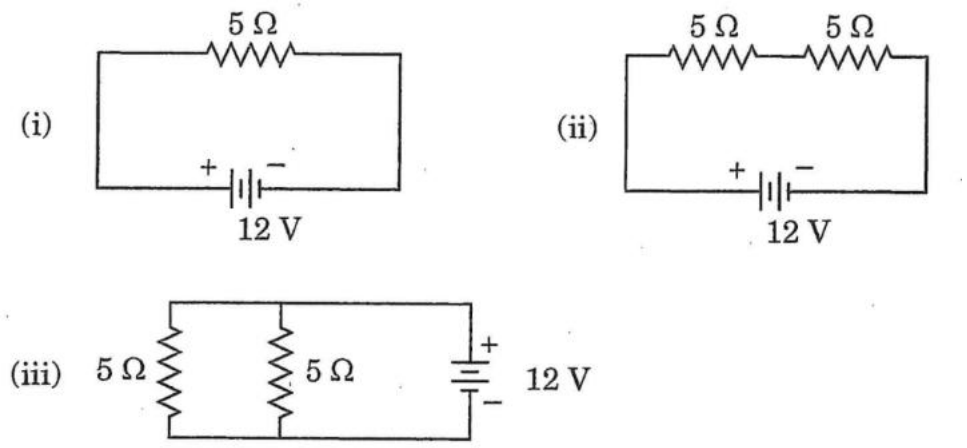
VERY SHORT ANSWER TYPE OF QUESTIONS: (2 MARK)

16) A wire of resistance R_1 is cut into five equal pieces. These five pieces of wire are then connected in parallel. If the resultant resistance of this combination be R_2, then find the ratio R_1/ R_2.

17) Heat produced per second due to a current in a resistor of 4 Ω is 400 J. Calculate the potential difference across the resistor.

18) Consider two lamps A and B of rating 50 W; 220 V and 25 W; 220 V respectively. Find the ratio of the resistances of the two lamps.

19) Consider the following circuits:

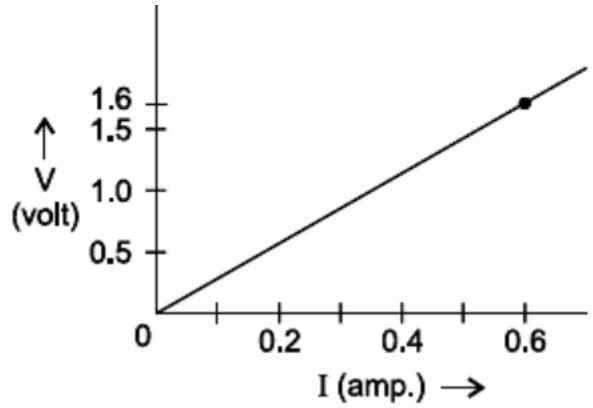


In which circuit will the power dissipated in the circuit be (I) minimum (II) maximum? Justify your answer.

20) Two electric bulbs have resistances in the ratio 1:2. If they are joined in series, then what is the ration of their energy consumed?

21) Two lamps, rated 100 W; 220 V and 60 W; 220 V are connected in parallel to electric main supply of 220 V. Find the current drawn by the two lamps from the supply.

22) Following graph was plotted between V and I value:



What would be the values of V /I ratios when the potential difference is 0.8 V, 1.2 V and 1.6 V respectively? What conclusion do you draw from these values?

23) An electric heater is connected to a 230 V main supply. A current of 8 A flows through the heater.

(a) How much charge flows around the circuit each second?

(b) How much energy is transferred to the heater each second?

24) Calculate the resistance of a copper wire of length 2 m and area of cross section 10^{-6} m^2. Resistivity of copper is 1.7×10^{-8} Ωm.

25) (a) Define one-volt potential difference between two points in an electric field.

(b) Draw a schematic diagram of an electric circuit of a cell of 1.5 V, 5 Ω and 10 Ω resistor and a plug key, all connected in series. Calculate the current drawn from the cell when the key is closed.

26) A wire of resistance R is cut into three equal parts. If these three parts are then joined in parallel, calculate the total resistance of the combination so formed.

27) Define electric power. When do we say that the power consumed in an electric circuit is 1 watt?

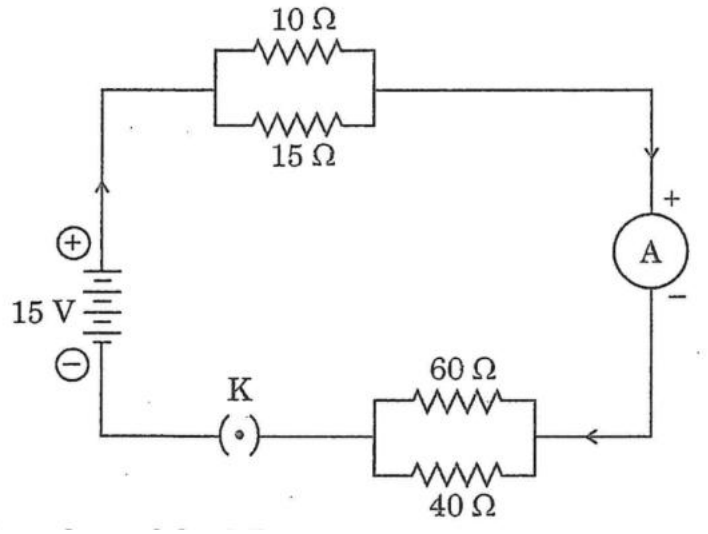
28) Two cylindrical wires of the same material have their lengths in the ratio of 4:9. What should be the ratio of their radii so that their resistances are in the ratio of 4:1?

SHORT ANSWER TYPE OF QUESTIONS (3 MARK):

29) Two resistors are connected in series across a 24 V supply and a current of 3 A flows in the circuit. If one of the resistors has a resistance of 2 Ω, determine (a) the value of the other resistor and (b) the potential difference across the 2 Ω resistor. If the circuit is connected for 50 hours, how much energy is used?

30) Define one ampere. The resistance of a wire of 0.01 cm radius is 14 Ω. If the resistivity of the material of the wire is 44×10^{-8} Ωm, find the length of the wire.

31) Consider the following electric circuit:



Calculate the values of the following:

a) The total resistance of the circuit.

b) The total current drawn from the source.

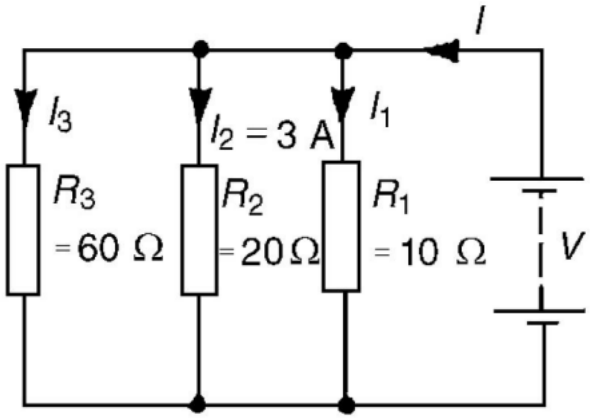
c) Potential difference across the parallel combination of 10 Ω and 15 Ω resistors.

32) (a)A current of 1 A is drawn by a filament of an electric bulb. Calculate the number of electrons passing through the cross-section of the filament in 30 minutes.

(b) Why are alloys used in electrical heating devices?

33) Write the relationship between resistivity and resistance of a cylindrical conductor of length *l* and area of cross section A. Hence derive the SI unit of resistivity.

34) For the circuit shown in below figure, find (a) the value of the supply voltage V and (b) the value of current I.



35) An electric bulb of resistance 20 Ω and a resistance wire of 4 Ω are connected in series with a 6 V battery. Draw the circuit diagram and calculate:

(a) total resistance of the circuit

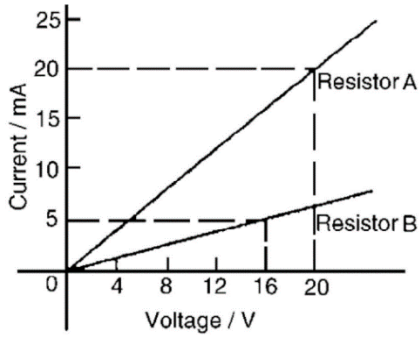
(b) current through the circuit

(c) potential difference across the electric bulb

(d) potential difference across the resistance wire.

LONG ANSWER TYPE OF QUESTIONS (5 MARK):

36) The current/voltage relationship for two resistors A and B is as shown in the figure below. Determine the value of the resistance of each resistor and also find the power dissipated through each resistor.



37) An electrical equipment in an office takes a current of 13 A from a 240 V supply. Estimate the cost per week of electricity if the equipment is used for 30 hours each week and 1 kWh of energy costs ₹7.

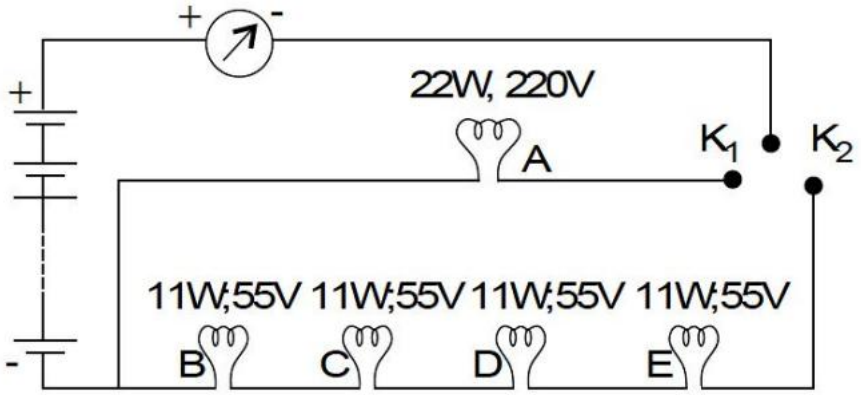
38)

a) Define electric power. Express it in terms of potential difference V and resistance R.

b) An electrical fuse is rated at 2A. What is meant by this statement?
c) An electric iron of 1 kW is operated at 220 V. Find which of the following fuses that respectively rated at 1 A, 3 A and 5 A can be used in it.

CASE STUDY TYPE OF QUESTIONS (4 MARK):

39) In a domestic circuit, five LED bulbs are arranged as shown. The source voltage is 220 V and the power rating of each bulb is marked in the circuit diagram.

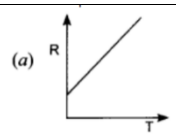


Based on the above circuit diagram, answer the following questions:
(a) State what happens when
(i) key K_1 is closed.
(ii) key K_2 is closed.
(b) Find the current drawn by the bulb B when it glows.
(c) Calculate
(i) the resistance of bulb B, and
(ii) total resistance of the combination of four bulbs B, C, D and E.
OR
(d) What would happen to the glow of all the bulbs in the circuit when keys 1 and K_2 both are closed and the bulb C suddenly get fused? Give reason to justify your answer.

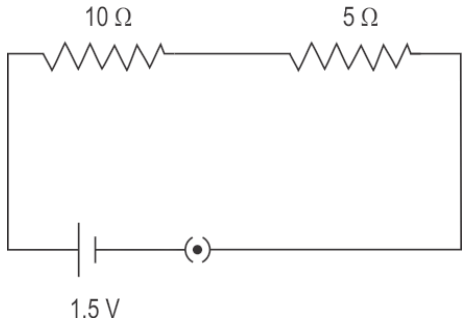
40) In our homes, we receive the supply of electric power through a main supply also called mains, either supported through overhead electric poles or by underground cables. In our country the potential difference between the two wires (live wire and neutral wire) of this supply is 220 V.
a) Write the colours of the insulation covers of the line wires through which supply comes to our homes.
b) What should be the current rating of the electric circuit (220 V) so that an electric iron of 1 kW power rating can be operated?
c) What is the function of the earth wire? State the advantage of the earth wire in domestic electric appliances such as an electric iron.

OR

d) List two precautions to be taken to avoid electrical accidents. State how these precautions prevent possible damage to the circuit/appliance.

ANSWER KEY	
1	c) 0.5 A
2	e) ρ
3	
4	a) Live wire
5	b) 2×10^5 joule
6	c) 8 A
7	b)3/5 Ω
8	b) 3
9	a) One-fourth
10	b) $R_2 < R_1$
11	b)Both A and R are true, and R is not the correct explanation of A.
12	c)A is true but R is false.
13	b)Both A and R are true, and R is not the correct explanation of A.
14	a)Both A and R are true, and R is the correct explanation of A.
15	c)A is true but R is false.
16	$\frac{1}{R'} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} + \frac{1}{R_4} + \frac{1}{R_5}$ $\frac{1}{R'} = \frac{1}{R/5} + \frac{1}{R/5} + \frac{1}{R/5} + \frac{1}{R/5} + \frac{1}{R/5}$ $\frac{1}{R'} = \frac{5}{R} + \frac{5}{R} + \frac{5}{R} + \frac{5}{R} + \frac{5}{R}$ $\frac{1}{R'} = \frac{25}{R}$ $R' = \frac{R}{25}$ $\frac{R}{R'} = \frac{R}{R/25}$ $\frac{R}{R'} = \frac{25\,R}{R}$ $\frac{R}{R'} = 25$

17	$P = \frac{V^2}{R}$ $\Rightarrow V^2 = P \times R$ $\Rightarrow V = \sqrt{P \times R}$ $\Rightarrow V = \sqrt{400 \times 4}$ $\Rightarrow V = \sqrt{1600}$ $\Rightarrow V = 40\ V$
18	$P = \frac{V^2}{R}$ $R_A = \frac{V_A^2}{P_A} = \frac{220^2}{50}$ $R_A = \frac{48400}{50} = 968\,\Omega$ $R_B = \frac{V_B^2}{P_B} = \frac{220^2}{25}$ $R_B = \frac{48400}{25} = 1936\,\Omega$ $\frac{R_A}{R_B} = \frac{968}{1936} = \frac{1}{2}$
19	$P = \frac{V^2}{R}$ Power is inversely proportional to resistance. Power is minimum in Circuit (ii) Power is maximum in Circuit (iii)
20	$P_1 = I^2 R_1$ $P_2 = I^2 R_2$ $\frac{P_1}{P_2} = \frac{I^2 R_1}{I^2 R_2} = \frac{R_1}{R_2}$ $\frac{P_1}{P_2} = \frac{1}{2}$
21	$I_1 = \frac{P_1}{V} = \frac{100}{220} = \frac{5}{11} A$ $I_2 = \frac{P_2}{V} = \frac{60}{220} = \frac{3}{11} A$ $I = I_1 + I_2 = \frac{5}{11} + \frac{3}{11} = \frac{8}{11} = 0.73A$

22	From the graph, when p.d is 1.6 V and 0.6 A current The ratio of V/I = 1.6 / 0.6 =2.67 Ω Therefore, straight line nature of graph shows that the value of ratio V / I for all potential difference of 0.8 V, 1.2 V and 1.6 volt will be same and is equal to 2.67 **Ω**. We conclude that at the given temperature, the resistance of wire is constant and is equal to 2.67 **Ω**.
23	Q = It Q = 8(1) = 8 C P = V I P = 230 (8) = 1840 W Thus, the energy transferred to the heater each second is 1840 joules**.**
24	$R = \rho \times \frac{L}{A}$ $R = (1.7 \times 10^{-8}) \times \frac{2}{10^{-6}}$ $R = 3.4 \times 10^{-2}\,\Omega$
25	a) One volt is the potential difference between two points in an electric circuit when joule of work is done to move charge of coulomb from one point to other. b)  $R_{\text{total}} = R_1 + R_2 = 5\,\Omega + 10\,\Omega = 15\,\Omega$ $I = \frac{V}{R_{\text{total}}}$ $I = \frac{1.5\,\text{V}}{15\,\Omega} = 0.1\,\text{A}$

26	$\frac{1}{R'} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$ $\frac{1}{R_{\text{total}}} = \frac{1}{\frac{R}{3}} + \frac{1}{\frac{R}{3}} + \frac{1}{\frac{R}{3}}$ $\frac{1}{R_{\text{total}}} = 3 \times \frac{3}{R} = \frac{9}{R}$ $R_{\text{total}} = \frac{R}{9}$
27	Electric power is defined as the rate at which electrical energy is transferred by an electric circuit. It is measured in watts (W). One watt is defined as the power consumed when one joule of energy is transferred in one second.
28	$R_1 = \rho \times \frac{L_1}{A_1} = \rho \times \frac{L_1}{\pi r_1^2}$ $R_2 = \rho \times \frac{L_2}{A_2} = \rho \times \frac{L_2}{\pi r_2^2}$ $\frac{R_1}{R_2} = \frac{\rho \times \frac{L_1}{\pi r_1^2}}{\rho \times \frac{L_2}{\pi r_2^2}} = \frac{L_1}{L_2} \times \frac{r_2^2}{r_1^2}$ $\frac{r_2^2}{r_1^2} = \frac{4}{1} \times \frac{9}{4} = 9$ $\frac{r_2}{r_1} = 3$ The ratio of the radii should be $\frac{r_1}{r_2} = \frac{1}{3}$ for their resistances to be in the ratio of 4:1.
29	a) $R_{\text{total}} = R_1 + R_2$ $V = I \times R_{\text{total}}$ $R_{\text{total}} = \frac{24}{3} = 8\,\Omega$ $R_{\text{total}} = R_1 + R_2$ $8\,\Omega = 2\,\Omega + R_2$ $R_2 = 8\,\Omega - 2\,\Omega = 6\,\Omega$ b) $V_1 = I \times R_1$ $V_1 = 3\,\text{A} \times 2\,\Omega = 6\,\text{V}$ c) $E = P \times t$

	$P = 24\,\text{V} \times 3\,\text{A} = 72\,\text{W}$ $E = 72\,\text{W} \times 180,000\,\text{s} = 12,960,000\,\text{J}$
30	One ampere (1 A) is defined as the current that flows when 1 coulomb of charge passes through a conductor in 1 second. $L = \frac{R \times A}{\rho}$ $L = \frac{14 \times 3.14 \times 10^{-8}}{44 \times 10^{-8}}$ $L = \frac{14 \times 3.14}{44}$ $L \approx 1\,\text{m}$
31	a) $R_1 = 10(15) / 10+15 = 6\ \Omega$ $R_2 = 60(40) / 60+40 = 24\ \Omega$ $R = R_1 + R_2 = 30\ \Omega$ b) $V = IR$ $I = 0.5$ A c) $V = IR = 3$ V
32	a) Using, $Q = It = 1 \times 1800 = 1800$ C Now, $Q = ne \Rightarrow$ $1800 = n \times 1.6 \times 10^{-19}$ $\Rightarrow n = \frac{1800}{1.6 \times 10^{-19}} = 1125 \times 10^{19}$ $\Rightarrow n = 1.125 \times 1022$ Hence, number of electrons passing through the filament in 30 minutes = 1.125×10^{22} electrons. $\simeq 10^{22}$ electrons b) The alloys are commonly used in electric heating device. This is because (i) Alloy are combination of two or more metals. (ii) Its resistivity is higher than that of its constituent metals. (iii) It neither gets oxidised nor burn easily at high temperature. (iv) It shows less rapid variations of resistivity due to change in temperature.
33	$R = \rho \times \frac{l}{A}$ $\text{Unit of } \rho = \text{Unit of } R \times \frac{\text{Unit of } A}{\text{Unit of } l}$ $\text{Unit of } \rho = \Omega \times \frac{\text{m}^2}{\text{m}}$ $\text{Unit of } \rho = \Omega \times \text{m}$

34

$$V = I_2 \times R_2$$

$$V = 3 \times 20 = 60\,V$$

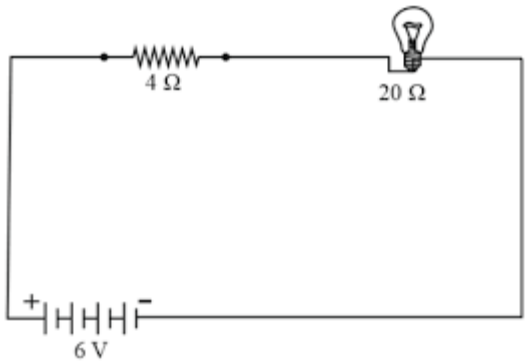
$$I = I_1 + I_2 + I_3$$

$$I_1 = \frac{V}{R_1} = \frac{60}{10} = 6\,A$$

$$I_3 = \frac{V}{R_3} = \frac{60}{60} = 1\,A$$

$$I = I_1 + I_2 + I_3 = 6 + 3 + 1 = 10\,A$$

35



$$R_{\text{total}} = R_{\text{bulb}} + R_{\text{wire}}$$

a) $R_{\text{total}} = 20\,\Omega + 4\,\Omega = 24\,\Omega$

$$I = \frac{V}{R_{\text{total}}}$$

b)

$$I = \frac{6\,\text{V}}{24\,\Omega} = 0.25\,\text{A}$$

$$V_{\text{bulb}} = I \times R_{\text{bulb}}$$

c) $V_{\text{bulb}} = 0.25\,\text{A} \times 20\,\Omega = 5\,\text{V}$

$$V_{\text{wire}} = I \times R_{\text{wire}}$$

d) $V_{\text{wire}} = 0.25\,\text{A} \times 4\,\Omega = 1\,\text{V}$

36

$$R = \frac{V}{I}$$

$$R_A = \frac{20\,V}{0.02\,A} = 1000\,\Omega = 1\,k\Omega$$

$$R_B = \frac{20\,V}{0.005\,A} = 4000\,\Omega = 4\,k\Omega$$

$$P = V \times I$$

$$P_A = 20\,V \times 0.02\,A = 0.4\,W$$

$$P_B = 20\,V \times 0.005\,A = 0.1\,W$$

37

$$P = V \times I$$

$$P = 240\,\text{V} \times 13\,\text{A} = 3120\,\text{W} = 3.12\,\text{kW}$$

$$E = \text{Power} \times \text{Time}$$

$$E = 3.12\,\text{kW} \times 30\,\text{hours} = 93.6\,\text{kWh}$$

$$\text{Cost} = 93.6\,\text{kWh} \times 7\,₹/\text{kWh}$$

The cost per week of electricity is **₹655.20**.

38

(a) Define electric power. Express it in terms of potential difference V and resistance R.
(b) An electrical fuse is rated at 2A. What is meant by this statement?
(c) An electric iron of 1 kW is operated at 220 V. Find which of the following fuses that respectively rated at 1 A, 3 A and 5 A can be used in it.
Ans.
(a) Electric power: It is the rate of doing work by an energy source or the rate at which the electrical energy is dissipated or consumed per unit time in the electric circuit is called electric power.

$$\text{So, Power } P = \frac{\text{Work done (W)}}{\text{Time } (t)} = \frac{\text{Electrical energy dissipated}}{\text{Time } (t)} = \frac{VIt}{t} = VI = \frac{V^2}{R}$$

(b) It means, the maximum current will flow through it is only 2 A. Fuse wire will melt if the current exceeds 2 A value through it.
(c) Given: $P = 1$ kW $= 1000$ W, $V = 220$ V

$$\text{Current drawn, } I = \frac{P}{V} = \frac{1000}{220} = \frac{50}{11} = 4.54 \text{ A}$$

To run electric iron of 1 kW, rated fuse of 5 A should be used.

39

What would happen to the glow of all the bulbs in the circuit when keys 1 and K_2 both are closed and the bulb C suddenly get fused? Give reason to justify your answer

Ans. (a) (i) Only bulb A will glow.

(ii) Bulbs B, C, D and E will glow.

(b) Let current drawn by bulb B = I

We know that, P = VI

$\Rightarrow I = \frac{P}{V} = \frac{11}{55} = \frac{1}{5} A = 0.2A$

(c) (i) Using Ohm's law, V = IR

$\Rightarrow R_B = \frac{V_B}{I} = \frac{55}{1/5} = 275\Omega$

(ii) Total resistance = $4 \times 275 = 1100\Omega$

OR

Only bulb A will glow. Bulbs B, D and E will not glow because in a series circuit when one bulb fuses, the entire circuit breaks and none of the bulb glows up.

40

a) **Live wire**: Red

Neutral wire: Blue

Earth wire: Green

b) $I = \frac{P}{V}$

$I = \frac{1000\ \text{W}}{220\ \text{V}} = 4.55\ \text{A}$

c) **Function of the Earth Wire:**

The earth wire provides a safe path for the flow of electric current to the ground in case of a fault (e.g., when the live wire touches the metal body of an appliance). This ensures that the appliance's metal body does not remain at a high potential and prevents electric shocks.

Advantage of the Earth Wire in Domestic Electric Appliances (e.g., Electric Iron):

In appliances like electric irons, the earth wire helps prevent the risk of electric shock if the live wire accidentally comes into contact with the metal casing of the appliance. The earth wire directs the fault current safely to the ground, reducing the risk of injury and ensuring the safety of the user.

OR

d) **Proper Insulation of Wires:**

- **Precaution**: Ensure that all electrical wires are properly insulated.
- **How it Prevents Damage**: Proper insulation prevents short circuits and accidental contact with live wires, reducing the risk of electric shock and fire hazards.

	Use of Fuses or Circuit Breakers: • **Precaution**: Install fuses or circuit breakers in the electrical circuit. • **How it Prevents Damage**: Fuses and circuit breakers protect the circuit from overloading. If the current exceeds the safe limit, the fuse blows or the circuit breaker trips, preventing damage to the appliances and reducing the risk of fire.

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