INDIAN SCHOOL AL WADI AL KABIR		
Class: X	**DEPARTMENT OF SCIENCE: 2026-27** **SUBJECT: PHYSICS**	**DATE: 31/10/2026**
WORKSHEET NO: 4 (WITH ANSWERS)	**TOPIC: ELECTRICITY**	**A4 FILE FORMAT** **(PORTFOLIO)**
CLASS & SEC:	**NAME OF THE STUDENT:**	**ROLL NO.**

OBJECTIVE TYPE QUESTIONS (1 MARK)

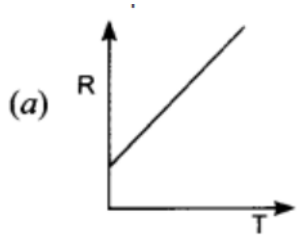
1) A cylindrical conductor of length l and uniform area of cross-section A has resistance R. Another conductor of length 2l and resistance R of the same material has an area of cross-section:

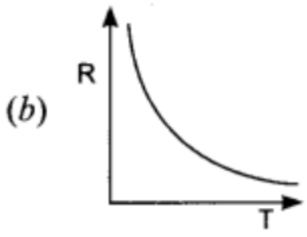
   a) A/2
   b) 3A/2
   c) 2A
   d) 3A

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

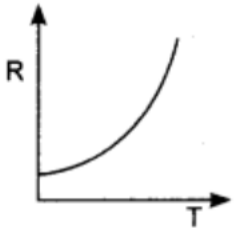
   a) ρ
   b) ρ/2
   c) 2 ρ
   d) 4 ρ

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

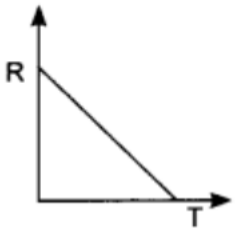




(c)



(d)



4) An ammeter and a voltmeter are connected in a circuit to measure current through and potential difference across a resistor, respectively. How should they be connected?

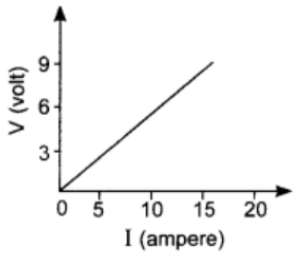
a) Both in series
b) Both in parallel
c) Ammeter in series, Voltmeter in parallel
d) Ammeter in parallel, Voltmeter in series

5) A battery of 10 volts 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) Three resistors of 6 Ω each are combined. How should they be connected to obtain an equivalent resistance of 9 Ω?

a) All three in series
b) All three in parallel
c) Two in parallel and one in series with them
d) Two in series and one in parallel with them

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) If the current passing through a fixed resistor is doubled, the rate of heat developed in it becomes:

a) Two times

b) Four times

c) One-half

d) One-fourth

9) Nichrome is widely used for making heating elements of electrical appliances because:

a) It has very low resistivity

b) It oxidises easily at high temperatures

c) It has high resistivity and does not oxidise easily at high temperatures

d) It has a low melting point

10) If R_1 and R_2 be the resistances of the filaments of 40 W and 60 W, respectively, operating at 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):

DIRECTIONS: 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):** Bending a conducting wire does not alter its electrical resistance.
Reason (R): Resistance of a wire depends on its length, cross-sectional area, resistivity, and temperature, but is independent of its physical bends.

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):** In domestic electric circuits, all electrical appliances are connected in parallel.
Reason (R): In a parallel connection, each appliance gets the same potential difference and operates independently even if one appliance fails.

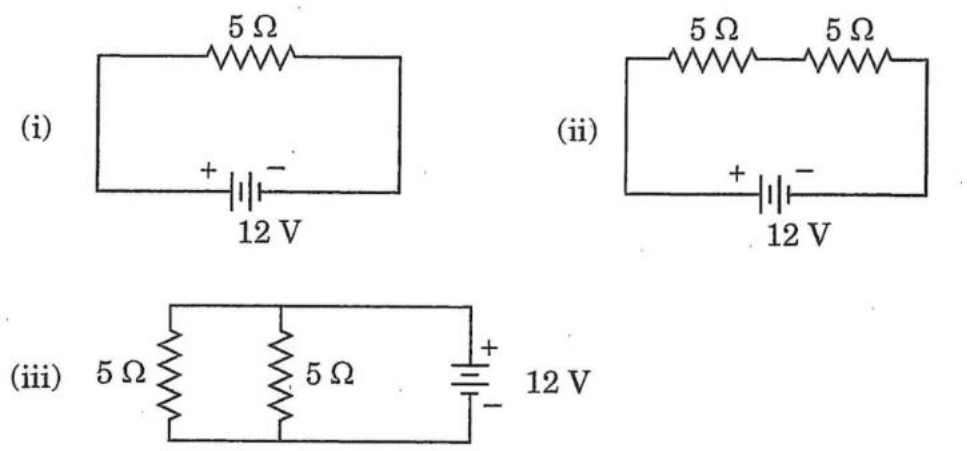
14) **Assertion (A):** A fuse wire is always connected in series with the live wire in household circuits.
Reason (R): If a fuse is connected in the neutral wire and blows due to overloading, the appliance remains connected to the live wire at high potential, posing an electric shock hazard.

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 MARKS)

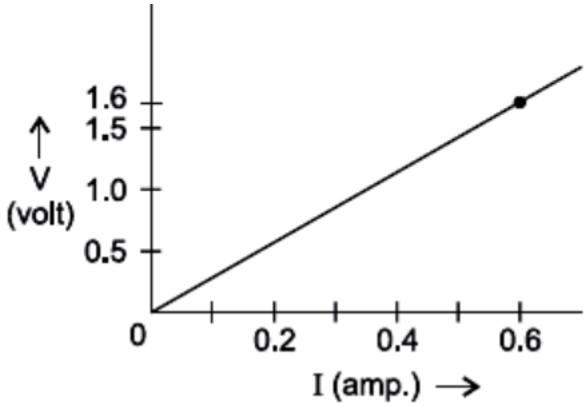
16) Why is Nichrome wire chosen as the heating element in electrical appliances like electric irons and toasters over metals like iron or silver? Give two specific scientific reasons. (CBSE 2023)

17) Consider the following circuits:



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

18) The following graph was plotted between V and I values:



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?

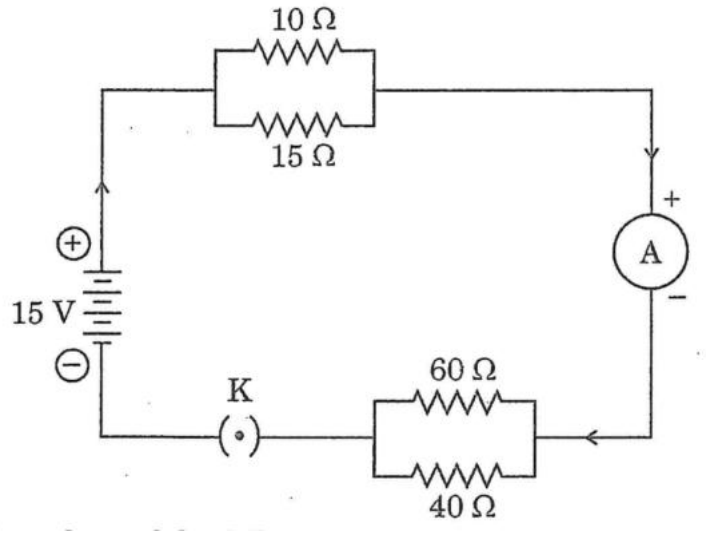
19) Calculate the resistance of a copper wire of length 2 m and area of cross section 10^{-6} m^2. The resistivity of copper is 1.7×10^{-8} Ωm.

SHORT ANSWER TYPE OF QUESTIONS (3 MARKS):

20) Two resistors R_1 = 20 Ω and R_2 = 30 Ω are connected in series across a 12 V power supply.
(i) Calculate the total heat energy generated in the circuit in 5 minutes.
(ii) If each resistor has a maximum safe power rating of 2 W, determine whether both resistors operate safely in this circuit. (CBSE 2026)

21) Two lamps, one rated 100 W at 220 V and the other 60 W at 220 V, are connected in parallel to an electric mains supply of 220 V. Calculate the total electric current drawn from the line. (CBSE 2023)

22) Consider the following electric circuit:



Calculate the values of the following:

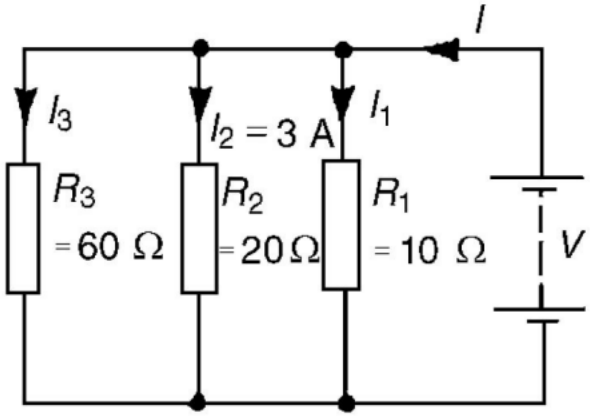
a) The total resistance of the circuit.

b) The total current drawn from the source.

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

23) An electric heater rated 1.5 kW is operated on a 220 V domestic power supply circuit fitted with a 5 A fuse. Will the fuse blow when the heater is switched on? Show detailed calculations. (CBSE 2024)

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



25) A cylindrical wire of length l and radius r has resistance R. The wire is drawn out (stretched) to double its length such that its volume remains constant. Derive the ratio of the new resistance to the original resistance. (CBSE 2024)

LONG ANSWER TYPE OF QUESTIONS (5 MARKS):

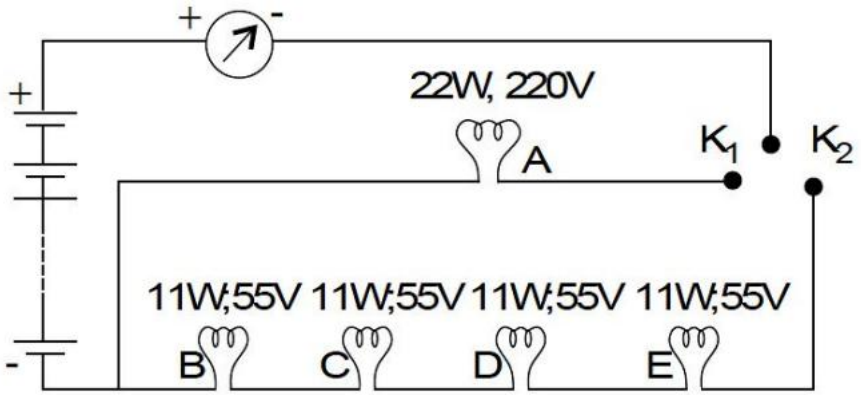
26) State Joule's Law of Heating. Why are copper and aluminium wires usually employed for electricity transmission, whereas tungsten is used almost exclusively for the filament of electric lamps? (CBSE 2025)

27) The arrangement of resistors shown in a circuit is connected to a battery source. A 100 Ω resistor is connected in the circuit, and the electrical power dissipated in this 100 Ω resistor is observed to be 81 W.
Calculate:
(a) The electric current flowing through the 100 Ω resistor and the main circuit.
(b) The potential difference recorded on voltmeter V_2 connected directly across the 100 Ω resistor.
(c) The reading on voltmeter V_1 connected across the entire circuit, given that the total equivalent resistance of the remaining network in series with the 100 Ω resistor is 20 Ω. (CBSE 2026)

28) A household in Oman uses a 2000 W Air Conditioner for 8 hours daily and five 15 W LED bulbs for 10 hours daily. Calculate: (a) Total commercial units (kWh) consumed in 30 days. (b) Electricity bill cost at a tariff rate of ₹ 7.00 per unit. (CBSE 2025)

CASE STUDY TYPE OF QUESTIONS (4 MARK):

29) 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) the 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 are both closed, and bulb C suddenly get fused? Give a reason to justify your answer.

30) A student sets up an electric circuit consisting of a battery of four 1.5 V cells connected in series, three resistors of resistances 5 Ω, 8 Ω and 12 Ω connected in series, and a plug key. The student closes the key to allow electric current to flow through the circuit.

Answer the following questions:

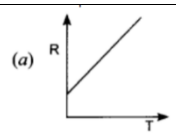
(a) What is the total potential difference supplied by the battery?

(b) Calculate the equivalent resistance of the combination of the three resistors.

(c) Calculate the potential difference across the 8 Ω resistor.

OR

(d)Calculate the heat produced in the 5 Ω resistor in 2 minutes. (CBSE 2025)

ANSWER KEY	
1	c) 2 A
2	e) ρ
3	
4	c) Ammeter in series, voltmeter in parallel
5	b) 2×10^5 joule
6	c) Two in parallel and one in series with them
7	b)3/5 Ω
8	b) Four times
9	c) It has high resistivity and does not oxidise easily at high temperatures
10	b) $R_2 < R_1$
11	a)Both A and R are true, and R is the correct explanation of A.
12	c)A is true but R is false.
13	a)Both A and R are true, and R is 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	1. Nichrome has high resistivity, so it produces considerable heat when current passes through it ($H = I^2Rt$). 2. It has a high melting point and does not oxidise easily at high temperatures, so it can become hot without melting or deteriorating quickly.
17	All circuits have the same 12 V source. For a fixed voltage, $P = V^2/R$. (i) Minimum power: circuit (ii), where two 5 Ω resistors are in series. $R = 5 + 5 = 10\ \Omega$, so $P = 12^2/10 = 14.4$ W. (ii) Maximum power: circuit (iii), where two 5 Ω resistors are in parallel. $R = (5 \times 5)/(5 + 5) = 2.5\ \Omega$, so $P = 12^2/2.5 = 57.6$ W. For comparison, circuit (i) has $R = 5\ \Omega$ and $P = 28.8$ W.
18	The graph is a straight line through the origin. Reading the graph: at V = 0.8 V, I ≈ 0.3 A; at V = 1.2 V, I ≈ 0.45 A; at V = 1.6 V, I ≈ 0.6 A. V/I = 0.8/0.3 ≈ 2.67 Ω; 1.2/0.45 ≈ 2.67 Ω; 1.6/0.6 ≈ 2.67 Ω.
19	$R = \rho \times \frac{L}{A}$ $R = (1.7 \times 10^{-8}) \times \frac{2}{10^{-6}}$ $R = 3.4 \times 10^{-2}\,\Omega$
20	(i) Total resistance: $R = 20 + 30 = 50\ \Omega$. Current: $I = V/R = 12/50 = 0.24$ A. Time t = 5 min = 300 s. Heat generated in the whole circuit: $H = I^2Rt = (0.24)^2 \times 50 \times 300 = 864$ J. (ii) Power in 20 Ω resistor: $P_1 = I^2R_1 = (0.24)^2 \times 20 = 1.152$ W. Power in 30 Ω resistor: $P_2 = (0.24)^2 \times 30 = 1.728$ W. Both are below the 2 W rating, so both operate safely under the stated conditions.
21	Both lamps receive 220 V. Total power P = 100 + 60 = 160 W. Using P = VI, I = P/V = 160/220 ≈ 0.727 A. Answer: approximately 0.73 A.
22	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
23	Power P = 1.5 kW = 1,500 W; voltage V = 220 V. I = P/V = 1500/220 ≈ 6.82 A. Since 6.82 A is greater than the fuse rating of 5 A, the fuse is expected to melt/blow when the heater operates, assuming the stated ratings and normal fuse operation.

24	$V = I_2 \times R_2$ $V = 3 \times 20 = 60\,V$ $I = I_1 + I_2 + I_3$ $I_1 = \frac{V}{R_1} = \frac{60}{10} = 6\,A$ $I_3 = \frac{V}{R_3} = \frac{60}{60} = 1\,A$ $I = I_1 + I_2 + I_3 = 6 + 3 + 1 = 10\,A$
25	Original resistance R = ρl/A. Since volume remains constant, Al = A′l′. Given l′ = 2l, A′(2l) = Al, hence A′ = A/2. New resistance R′ = ρl′/A′ = ρ(2l)/(A/2) = 4ρl/A = 4R. Therefore R′/R = 4, or the ratio of new resistance to original resistance is 4:1.
26	Joule's law of heating: The heat produced in a resistor by an electric current is directly proportional to the square of the current, the resistance, and the time for which current flows. H = I²Rt. Equivalent forms are H = VIt and H = V²t/R when the relevant quantities are constant. Copper and aluminium are used for transmission wires because they have low resistivity (high electrical conductivity), so energy loss as heat (I²R loss) is small. They are also ductile and can be drawn into wires. Tungsten is used for lamp filaments because it has a very high melting point and can withstand the high temperature needed to emit light. Its relatively high resistivity allows a thin filament to produce substantial heat at operating current.
27	(a) Given P = 81 W and R = 100 Ω. From P = I²R, I = √(P/R) = √(81/100) = 0.9 A. Since the 100 Ω resistor is in series with the remaining network, the main circuit current is also 0.9 A. (b) Voltage across the 100 Ω resistor: V_2 = IR = 0.9 × 100 = 90 V. (c) Total resistance = 100 + 20 = 120 Ω. Supply voltage (reading of V_1) = I Rtotal = 0.9 × 120 = 108 V.
28	Air conditioner: 2000 W = 2 kW. Daily energy = 2 × 8 = 16 kWh. Five LED bulbs: total power = 5 × 15 W = 75 W = 0.075 kW. Daily energy = 0.075 × 10 = 0.75 kWh. Total daily consumption = 16 + 0.75 = 16.75 kWh. For 30 days: 16.75 × 30 = 502.5 kWh (commercial units). Cost = 502.5 × ₹7 = ₹3,517.50. This calculation excludes any fixed charges, taxes, or slab-based tariff adjustments.

29	(a)(i) When K_1 is closed, bulb A's branch is completed. Bulb A, rated 220 V, receives the 220 V supply and glows. (a)(ii) When K_2 is closed, the branch containing B, C, D and E is completed. The four 11 W, 55 V bulbs are in series; their rated voltages add to $4 \times 55 = 220$ V, so they are designed to operate together across the 220 V supply. (b) Current through bulb B when it glows: $I = P/V = 11/55 = 0.20$ A. (c)(i) Resistance of bulb B at its rated operating conditions: $R = V^2/P = 55^2/11 = 275\ \Omega$. (c)(ii) Four identical bulbs in series: $R_{total} = 4 \times 275 = 1{,}100\ \Omega$. OR (d) If both keys are closed and bulb C fuses, the series branch containing B, C, D and E becomes an open circuit. Therefore B, C, D and E go out. Bulb A remains glowing because it is on a separate parallel branch and its circuit remains complete.
30	(a) Total battery voltage = $4 \times 1.5 = 6$ V. (b) Equivalent resistance in series: $R_{total} = 5 + 8 + 12 = 25\ \Omega$. Current in circuit: $I = V/R = 6/25 = 0.24$ A. (c) Potential difference across the 8 Ω resistor: $V_8 = IR = 0.24 \times 8 = 1.92$ V. OR (d) Heat in the 5 Ω resistor in 2 min: $t = 120$ s. $H = I^2Rt = (0.24)^2 \times 5 \times 120 = 34.56$ J.

Prepared by: *Ms Vivette Lasrado*	*Checked by:* *HOD Science*