UNIQUE STUDY POINT

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Class: X	**Subject:** Science	**Session:** 2025-26
Chapter: 11 - Electricity	**Time:** 1½ Hours	**Max. Marks:** 40

General Instructions:

1. All questions are compulsory.
2. This question paper contains 20 questions divided into five sections A, B, C, D and E.
3. Section A contains 10 MCQs of 1 mark each.
4. Section B contains 4 questions of 2 marks each.
5. Section C contains 3 questions of 3 marks each.
6. Section D contains 1 question of 5 marks.
7. Section E contains 2 Case Study Based questions of 4 marks each.

SECTION A - Multiple Choice Questions (1 mark each)

Q1. The SI unit of resistance is:

(a) Volt

(b) Ampere

(c) Ohm

(d) Coulomb

Q2. Which instrument is used to measure potential difference?

(a) Ammeter

(b) Voltmeter

(c) Galvanometer

(d) Rheostat

Q3. The SI unit of electric power is:

(a) Joule

(b) Watt

(c) Kilowatt hour

(d) Volt ampere

Q4. If the current flowing through a conductor is doubled, the heat produced will become:

(a) Half

(b) Double

(c) Four times

(d) Eight times

Q5. An ammeter should have:

(a) High resistance

(b) Low resistance

(c) Infinite resistance

(d) Zero resistance

Q6. A wire of resistance R is cut into 5 equal parts. These parts are connected in parallel. The equivalent resistance will be:

(a) R/5

(b) R/25

(c) 5R

(d) 25R

Q7. Which of the following represents the correct formula for electric power?

(a) P = V/I

(b) P = I/V

(c) P = VI

(d) P = V + I

Q8. The resistivity of metals is in the range of:

(a) 10^{-8} to 10^{-6} Ω m

(b) 10^{-2} to 10^{-1} Ω m

(c) 10^{2} to 10^{4} Ω m

(d) 10^{12} to 10^{17} Ω m

Q9. The work done in moving a charge of 2 C across two points having a potential difference of 10 V is:

(a) 5 J

(b) 10 J

(c) 20 J

(d) 40 J

Q10. In domestic wiring, all appliances are connected in:

(a) Series

(b) Parallel

(c) Mixed (series and parallel)

(d) None of these

SECTION B - Short Answer Questions (2 marks each)

Q11. What is meant by saying that the potential difference between two points is 1 V? Define 1 volt.

Q12. Why is series arrangement not used in domestic circuits? Give two reasons.

Q13. An electric bulb is rated 220 V, 100 W. Calculate its resistance.

Q14. Name the device that helps to maintain a potential difference across a conductor. What is its function?

SECTION C - Short Answer Questions (3 marks each)

Q15. Two resistors of 10 Ω and 20 Ω are connected: (a) in series (b) in parallel. Calculate the equivalent resistance in each case.

Q16. A current of 0.5 A is drawn by a filament of an electric bulb for 20 minutes. Find the amount of electric charge that flows through the circuit.

Q17. Explain the heating effect of electric current. Write Joule's law of heating and mention three applications of this effect.

SECTION D - Long Answer Question (5 marks)

Q18. (a) What is meant by resistance of a conductor? On what factors does it depend?

(b) A metal wire has a resistance of 20 Ω at 20°C. Another wire of the same material has double the length and double the area of cross-section. Calculate its resistance at the same temperature.
(c) Why are copper and aluminium wires usually employed for electricity transmission?

SECTION E - Case Study Based Questions (4 marks each)

Q19. Case Study 1:
A student wants to study the effect of current on the amount of heat produced in a resistor. He sets up a circuit with a battery, a rheostat (variable resistor), an ammeter, and a resistor of fixed resistance R = 10 Ω. He varies the current and notes the ammeter readings. The resistor is immersed in water and the rise in temperature is noted for different currents. Time is kept constant at t = 5 minutes = 300 s for all observations.

Current (A)	Temperature rise (°C)
1	2
2	8
3	18

Based on this experiment, answer the following:
(a) What can you conclude about the relationship between current and heat produced? (1 mark)
(b) Calculate the heat produced when current is 2 A. (2 marks)
(c) If the resistance is doubled keeping current same (2 A), what will be the heat produced? (1 mark)

Q20. Case Study 2:
In an electric circuit, three lamps L_1, L_2 and L_3 are connected in parallel to a 12 V battery. The resistances of the lamps are 4 Ω, 6 Ω and 12 Ω respectively. A switch is connected in the main line before the parallel combination.

Based on this arrangement, answer the following:
(a) When the switch is closed, what will be the potential difference across each lamp? (1 mark)
(b) Calculate the current through each lamp. (2 marks)
(c) If lamp L_2 gets fused, will the other two lamps continue to glow? Justify your answer. (1 mark)

DETAILED ANSWER KEY - PAPER 03

SECTION A - Answers to MCQs

Ans 1. (c) Ohm

Ans 2. (b) Voltmeter

Ans 3. (b) Watt

Ans 4. (c) Four times

Ans 5. (b) Low resistance

Ans 6. (b) R/25

Ans 7. (c) P = VI

Ans 8. (a) 10^{-8} to 10^{-6} Ω m

Ans 9. (c) 20 J

Ans 10. (b) Parallel

SECTION B - Answers to Short Answer Questions

Ans 11.

When the potential difference between two points is 1 V, it means that 1 joule of work is done in moving 1 coulomb of charge from one point to the other.

Definition of 1 Volt:
One volt is the potential difference between two points in a current carrying conductor when 1 joule of work is done to move a charge of 1 coulomb from one point to the other.

1 V = 1 J / 1 C

Ans 12.

Series arrangement is not used in domestic circuits because:

1. In series, all appliances get the same current, but different appliances require different amounts of current to work properly

2. If one appliance is switched off or stops working, the entire circuit breaks and all other appliances stop functioning

Ans 13.

Given: V = 220 V, P = 100 W

Using the formula: $P = V^2/R$
$R = V^2/P$
$R = (220)^2/100$
$R = 48400/100$
$R = 484\ \Omega$

The resistance of the electric bulb is 484 Ω.

Ans 14.

A **cell or battery** helps to maintain a potential difference across a conductor.

Function: The chemical action within a cell generates the potential difference across its terminals. When the cell is connected to a conducting circuit, this potential difference sets the charges in motion and produces an electric current.

SECTION C - Answers to Short Answer Questions

Ans 15.

Given: $R_1 = 10\ \Omega$, $R_2 = 20\ \Omega$

(a) **In series:**
$Rs = R_1 + R_2$
$Rs = 10 + 20 = 30\ \Omega$

(b) **In parallel:**
$1/Rp = 1/R_1 + 1/R_2$
$1/Rp = 1/10 + 1/20$
$1/Rp = 2/20 + 1/20 = 3/20$
$Rp = 20/3 = 6.67\ \Omega$

Ans 16.

Given: I = 0.5 A, t = 20 minutes = 20 × 60 = 1200 seconds

Using the formula: $Q = I \times t$
$Q = 0.5 \times 1200$
$Q = 600$ C

Therefore, 600 coulombs of electric charge flows through the circuit.

Ans 17.

Heating Effect of Electric Current:
When electric current flows through a conductor, heat is produced due to the resistance offered by the conductor. This is known as the heating effect of electric current.

Joule's Law of Heating:
$H = I^2Rt$
The heat produced is:
- Directly proportional to the square of current (I^2)
- Directly proportional to resistance (R)
- Directly proportional to time (t)

Applications:
1. Electric iron
2. Electric heater
3. Electric bulb

SECTION D - Answer to Long Answer Question

Ans 18.

(a) **Resistance:** Resistance is the property of a conductor to oppose the flow of electric current through it. It is

measured in ohm (Ω).

Factors on which resistance depends:
1. Length of the conductor ($R \propto l$)
2. Area of cross-section ($R \propto 1/A$)
3. Nature of material (resistivity ρ)
4. Temperature of the conductor

(b) For first wire: $R_1 = 20\ \Omega$, length = l, area = A
$R_1 = \rho(l/A) = 20\ \Omega$

For second wire: length = 2l, area = 2A
$R_2 = \rho(2l/2A) = \rho(l/A) = 20\ \Omega$

Therefore, the resistance remains the same = 20 Ω

(c) Copper and aluminium wires are employed for electricity transmission because:
1. They have very low resistivity, which minimizes energy loss during transmission
2. They are good conductors of electricity and relatively inexpensive

SECTION E - Answers to Case Study Based Questions

Ans 19.

(a) From the data:
- When current = 1 A, temperature rise = 2°C
- When current = 2 A (doubled), temperature rise = 8°C (4 times)
- When current = 3 A (tripled), temperature rise = 18°C (9 times)

Conclusion: Heat produced is directly proportional to the square of current ($H \propto I^2$). This verifies Joule's law of heating.

(b) Given: I = 2 A, R = 10 Ω, t = 300 s
Using $H = I^2Rt$
$H = (2)^2 \times 10 \times 300$
$H = 4 \times 10 \times 300$
H = 12,000 J = 12 kJ

(c) If R is doubled (R = 20 Ω), with I = 2 A and t = 300 s:
$H = I^2Rt = (2)^2 \times 20 \times 300$
$H = 4 \times 20 \times 300 = 24{,}000$ J = 24 kJ
(The heat produced will be doubled)

Ans 20.

(a) In a parallel circuit, all components receive the same voltage as the source.
Therefore, the potential difference across each lamp = 12 V

(b) Current through each lamp (Using I = V/R):
- Through L_1: $I_1 = 12/4 = 3$ A
- Through L_2: $I_2 = 12/6 = 2$ A
- Through L_3: $I_3 = 12/12 = 1$ A

(c) Yes, the other two lamps (L_1 and L_3) will continue to glow.
Justification: In a parallel circuit, each component has an independent path to the battery. If one component fails, it does not affect the operation of other components. Therefore, even if L_2 gets fused, L_1 and L_3 will continue to receive the full voltage and will continue to glow.

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