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 resistivity is:

(a) Ω

(b) Ω m

(c) Ω/m

(d) m/Ω

Q2. Electric current is a:

(a) Scalar quantity

(b) Vector quantity

(c) Neither scalar nor vector

(d) Both scalar and vector

Q3. The melting point of tungsten is:

(a) 1000°C

(b) 2000°C

(c) 3380°C

(d) 5000°C

Q4. The formula for electric energy is:

(a) $E = Pt$

(b) $E = P/t$

(c) $E = t/P$

(d) $E = P \times t^2$

Q5. When three resistors of equal resistance are connected in series, the equivalent resistance is:

(a) R/3

(b) R

(c) 2R

(d) 3R

Q6. The device used to change resistance in a circuit is:

(a) Ammeter

(b) Voltmeter

(c) Rheostat

(d) Galvanometer

Q7. One ampere is equal to:

(a) 1 C/1 min

(b) 1 C/1 s

(c) 1 C/1 hour

(d) 1 s/1 C

Q8. Among copper, silver, nichrome and tungsten, which has the highest resistivity?

(a) Copper

(b) Silver

(c) Nichrome

(d) Tungsten

Q9. If the area of cross-section of a wire is doubled, its resistance becomes:

(a) Double

(b) Half

(c) Four times

(d) One-fourth

Q10. The graph between V and I for a conductor at constant temperature is:

(a) Parabola

(b) Straight line

(c) Curve

(d) Circle

SECTION B - Short Answer Questions (2 marks each)

Q11. Define one ampere. Write the relationship between charge, current and time.

Q12. What are the advantages of connecting electrical devices in parallel? Give two advantages.

Q13. How much energy is given to each coulomb of charge passing through a 9 V battery?

Q14. Why is the cord of an electric heater not glowing while the heating element does?

SECTION C - Short Answer Questions (3 marks each)

Q15. An electric lamp of resistance 100 Ω, a toaster of resistance 50 Ω, and a water filter of resistance 500 Ω are connected in parallel to a 220 V source. Calculate the total current drawn from the source.

Q16. Compute the heat generated while transferring 96000 coulombs of charge through a potential difference of 40 V in one hour.

Q17. The potential difference between the terminals of an electric heater is 60 V when it draws a current of 4 A from the source. What current will the heater draw if the potential difference is increased to 180 V?

SECTION D - Long Answer Question (5 marks)

Q18. (a) State and explain Ohm's law. Write the mathematical expression.
(b) Draw a V-I graph for a metallic conductor and explain its significance.

(c) Calculate the resistance of a conductor if a current of 2 A flows through it when a potential difference of 12 V is applied across its ends.

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

Q19. Case Study 1:
An electrician has to repair an electric iron consuming 1100 W at 220 V. He finds that the heating element has burnt out. He decides to replace it with a new heating element.

To select the correct element, he needs to calculate some parameters.

Based on this situation, answer the following:
(a) Calculate the current that should flow through the electric iron when operating normally. (1 mark)
(b) Calculate the resistance of the heating element. (1 mark)
(c) If the iron operates for 2 hours daily, calculate the electrical energy consumed in one month (30 days). Express your answer in kWh. (2 marks)

Q20. Case Study 2:
A physics teacher wants to demonstrate the factors affecting resistance. She takes three wires A, B and C of the same material. The specifications are:

- Wire A: Length = l, Area of cross-section = A
- Wire B: Length = $2l$, Area of cross-section = A
- Wire C: Length = l, Area of cross-section = $2A$

If the resistance of wire A is $R_0 = 10\ \Omega$, answer the following:
(a) What is the relationship between resistance and length? Calculate the resistance of wire B. (2 marks)
(b) What is the relationship between resistance and area of cross-section? Calculate the resistance of wire C. (2 marks)

DETAILED ANSWER KEY - PAPER 04

SECTION A - Answers to MCQs

Ans 1. (b) Ω m

Ans 2. (a) Scalar quantity

Ans 3. (c) 3380°C

Ans 4. (a) E = Pt

Ans 5. (d) 3R

Ans 6. (c) Rheostat

Ans 7. (b) 1 C/1 s

Ans 8. (c) Nichrome

Ans 9. (b) Half

Ans 10. (b) Straight line

SECTION B - Answers to Short Answer Questions

Ans 11.

One Ampere: One ampere is the current that flows when one coulomb of charge passes through a conductor in one second.

Relationship:
Current = Charge / Time
I = Q / t

where I = current (in amperes), Q = charge (in coulombs), t = time (in seconds)

Ans 12.

Advantages of connecting electrical devices in parallel:

1. Each device gets the full voltage of the source, so they work at their rated efficiency

2. Each device can be operated independently. If one device is switched off or fails, the others continue to work normally

Ans 13.

Given: Potential difference V = 9 V
Charge = 1 coulomb

Energy given to each coulomb = Work done / Charge = V × Q / Q = V
Energy = 9 V × 1 C = 9 J

Therefore, 9 joules of energy is given to each coulomb of charge.

Ans 14.

The cord of an electric heater does not glow because:

The cord has very low resistance compared to the heating element. According to Joule's law ($H = I^2Rt$), heat produced is directly proportional to resistance. Since the same current flows through both the cord and heating element, but the heating element has much higher resistance, it produces much more heat and glows, while the cord remains cool.

SECTION C - Answers to Short Answer Questions

Ans 15.

Given: $R_1 = 100\ \Omega$, $R_2 = 50\ \Omega$, $R_3 = 500\ \Omega$, $V = 220$ V
All connected in parallel

Current through each appliance (Using $I = V/R$):
$I_1 = 220/100 = 2.2$ A
$I_2 = 220/50 = 4.4$ A
$I_3 = 220/500 = 0.44$ A

Total current from source:
$I = I_1 + I_2 + I_3$
$I = 2.2 + 4.4 + 0.44 = 7.04$ A

Ans 16.

Given: Q = 96000 C, V = 40 V, t = 1 hour

Heat generated = Work done = $V \times Q$
$H = 40 \times 96000$
$H = 3{,}840{,}000$ J
$H = 3.84 \times 10^6$ J
$H = 3840$ kJ

Ans 17.

Given: $V_1 = 60$ V, $I_1 = 4$ A

First, calculate the resistance:
$R = V_1/I_1 = 60/4 = 15\ \Omega$

When $V_2 = 180$ V, the new current will be:
$I_2 = V_2/R = 180/15 = 12$ A

The heater will draw 12 A when the potential difference is 180 V.

SECTION D - Answer to Long Answer Question

Ans 18.

(a) **Ohm's Law:** Ohm's law states that the potential difference (V) across the ends of a conductor is directly proportional to the current (I) flowing through it, provided its temperature and other physical conditions remain constant.

Mathematically: $V \propto I$
$V = IR$
or $R = V/I$

where R is the resistance of the conductor and is a constant for a given conductor at a given temperature.

(b) **V-I Graph:** The V-I graph for a metallic conductor is a straight line passing through the origin. This shows that:
- V is directly proportional to I
- The slope of the line gives the resistance (R = V/I)
- The straight line confirms Ohm's law

(c) Given: I = 2 A, V = 12 V
Using Ohm's law: R = V/I
R = 12/2 = 6 Ω

The resistance of the conductor is 6 Ω.

SECTION E - Answers to Case Study Based Questions

Ans 19.

(a) Given: P = 1100 W, V = 220 V
Using P = VI
I = P/V = 1100/220 = 5 A

The current flowing through the electric iron is 5 A.

(b) Resistance of heating element:
R = V/I = 220/5 = 44 Ω
Or $R = V^2/P = (220)^2/1100 = 48400/1100 = 44\ \Omega$

(c) Daily usage = 2 hours
Total usage in 30 days = 2 × 30 = 60 hours
Power = 1100 W = 1.1 kW

Energy consumed = Power × Time
E = 1.1 kW × 60 h
E = 66 kWh or 66 units

The electrical energy consumed in one month is 66 kWh.

Ans 20.

(a) **Relationship between resistance and length:**
Resistance is directly proportional to the length of the conductor (R ∝ l).

For wire A: $R_0 = \rho(l/A) = 10\ \Omega$
For wire B: Length = 2l, Area = A
$R_B = \rho(2l/A) = 2 \times \rho(l/A) = 2 \times R_0$
$R_B = 2 \times 10 = 20\ \Omega$

The resistance of wire B is 20 Ω.

(b) **Relationship between resistance and area of cross-section:**
Resistance is inversely proportional to the area of cross-section (R ∝ 1/A).

For wire C: Length = l, Area = 2A
$R_C = \rho(l/2A) = (1/2) \times \rho(l/A) = R_0/2$
$R_C = 10/2 = 5\ \Omega$

The resistance of wire C is 5 Ω.

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