

UNIQUE STUDY POINT

By Sumeet Sahu

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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 electric current is:

- (a) Volt
- (b) Ampere
- (c) Ohm
- (d) Watt

Q2. An electric circuit must have a:

- (a) Open path
- (b) Continuous and closed path
- (c) Broken path
- (d) None of these

Q3. The device used to measure electric current in a circuit is:

- (a) Voltmeter
- (b) Ammeter
- (c) Galvanometer
- (d) Potentiometer

Q4. According to Ohm's law, the relationship between V, I and R is:

- (a) $V = I + R$
- (b) $V = I - R$
- (c) $V = I \times R$
- (d) $V = I / R$

Q5. The resistivity of a conductor depends on:

- (a) Length of the conductor
- (b) Area of cross-section
- (c) Material of the conductor
- (d) All of these

Q6. When resistors are connected in series, the total resistance is:

- (a) Less than the smallest resistance
- (b) Equal to the sum of all resistances
- (c) Equal to the product of all resistances
- (d) Equal to the average of all resistances

Q7. The commercial unit of electrical energy is:

- (a) Joule
- (b) Watt
- (c) Kilowatt hour
- (d) Volt ampere

Q8. The material commonly used for electrical transmission lines is:

- (a) Nichrome
- (b) Tungsten
- (c) Copper
- (d) Manganin

Q9. One coulomb of charge is equivalent to the charge of nearly:

- (a) 6×10^{16} electrons
- (b) 6×10^{18} electrons
- (c) 6×10^{20} electrons
- (d) 6×10^{22} electrons

Q10. The heating effect of electric current is used in:

- (a) Electric iron
- (b) Electric bulb
- (c) Electric fuse
- (d) All of these

SECTION B - Short Answer Questions (2 marks each)

Q11. Define electric current and write its formula. What is the direction of conventional current?

Q12. State Ohm's law. Draw a circuit diagram to verify Ohm's law.

Q13. Why is tungsten used for making filaments of electric bulbs? Give two reasons.

Q14. A current of 2 A flows through a conductor for 5 minutes. Calculate the amount of charge transferred.

SECTION C - Short Answer Questions (3 marks each)

Q15. Derive the formula for equivalent resistance when three resistors R_1 , R_2 and R_3 are connected in series.

Q16. An electric heater of resistance 50Ω is connected to a 220 V supply. Calculate: (a) the current flowing through it, (b) the power consumed.

Q17. Explain the factors on which the resistance of a conductor depends. Write the relationship between them.

SECTION D - Long Answer Question (5 marks)

Q18. (a) State Joule's law of heating.

(b) An electric iron consumes 1000 W of power when operating at 220 V. Calculate:

- (i) The current flowing through it
- (ii) The resistance of the electric iron

(iii) The heat generated in 2 hours

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

Q19. Case Study 1:

In a household, different electrical appliances are connected in parallel to the main supply. A household has the following appliances connected to a 220 V supply: a 100 W bulb, a 60 W bulb, and a 1000 W electric iron. All these appliances are connected in parallel.

Based on this information, answer the following:

- Why are household appliances connected in parallel and not in series? (1 mark)
- Calculate the current drawn by each appliance. (2 marks)
- What is the total current drawn from the main supply? (1 mark)

Q20. Case Study 2:

A student performed an experiment to verify Ohm's law. He set up a circuit with a nichrome wire of length 0.5 m, an ammeter, a voltmeter, and four cells of 1.5 V each. He noted the ammeter and voltmeter readings for different numbers of cells connected.

Number of cells	Potential difference (V)	Current (A)
1	1.5	0.3
2	3.0	0.6
3	4.5	0.9
4	6.0	1.2

Based on this data, answer the following:

- Calculate the resistance of the nichrome wire using any one set of readings. (1 mark)
- Does this experiment verify Ohm's law? Justify your answer. (2 marks)
- What would be the nature of the V-I graph for this experiment? (1 mark)

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SECTION A - Answers to MCQs

Ans 1. (b) Ampere

Ans 2. (b) Continuous and closed path

Ans 3. (b) Ammeter

Ans 4. (c) $V = I \times R$

Ans 5. (c) Material of the conductor

Ans 6. (b) Equal to the sum of all resistances

Ans 7. (c) Kilowatt hour

Ans 8. (c) Copper

Ans 9. (b) 6×10^{18} electrons

Ans 10. (d) All of these

SECTION B - Answers to Short Answer Questions

Ans 11.

Electric current is the rate of flow of electric charges through a conductor.

Formula: $I = Q/t$

where I = current, Q = charge, t = time

The direction of conventional current is taken as opposite to the direction of flow of electrons, i.e., from positive terminal to negative terminal.

Ans 12.

Ohm's Law states that the potential difference across the ends of a conductor is directly proportional to the current flowing through it, provided its temperature remains constant.

Mathematically: $V = IR$

Circuit diagram: A circuit with a battery, ammeter in series, nichrome wire as resistor, voltmeter in parallel across the wire, and a plug key would be drawn to verify Ohm's law.

Ans 13.

Tungsten is used for making filaments of electric bulbs because:

1. It has a very high melting point (3380°C), so it can be heated to high temperatures without melting
2. It has high resistivity, which allows it to produce heat and light efficiently

Ans 14.

Given: $I = 2 \text{ A}$, $t = 5 \text{ minutes} = 5 \times 60 = 300 \text{ seconds}$

Using formula: $Q = I \times t$

$Q = 2 \text{ A} \times 300 \text{ s}$

$Q = 600 \text{ coulomb}$

Therefore, 600 coulombs of charge is transferred.

SECTION C - Answers to Short Answer Questions

Ans 15.

When three resistors R_1 , R_2 and R_3 are connected in series:

- The same current I flows through each resistor
- The total potential difference $V = V_1 + V_2 + V_3$

By Ohm's law:

$$V_1 = IR_1, V_2 = IR_2, V_3 = IR_3$$

If R_s is the equivalent resistance:

$$V = IR_s$$

Therefore: $IR_s = IR_1 + IR_2 + IR_3$

$$IR_s = I(R_1 + R_2 + R_3)$$

$$\mathbf{R_s = R_1 + R_2 + R_3}$$

Ans 16.

Given: $R = 50 \Omega$, $V = 220 \text{ V}$

(a) Current flowing: $I = V/R = 220/50 = 4.4 \text{ A}$

(b) Power consumed: $P = V \times I = 220 \times 4.4 = 968 \text{ W}$

Or $P = V^2/R = (220)^2/50 = 48400/50 = 968 \text{ W}$

Ans 17.

The resistance of a conductor depends on:

1. **Length (l):** Resistance is directly proportional to length ($R \propto l$)
2. **Area of cross-section (A):** Resistance is inversely proportional to area ($R \propto 1/A$)
3. **Nature of material (ρ):** Resistance depends on the resistivity of the material

Relationship: $R = \rho(l/A)$

where ρ is the resistivity of the material.

SECTION D - Answer to Long Answer Question

Ans 18.

(a) **Joule's Law of Heating:** The heat produced in a resistor is:

- Directly proportional to the square of current ($H \propto I^2$)
- Directly proportional to resistance ($H \propto R$)
- Directly proportional to time ($H \propto t$)

Formula: $H = I^2Rt$ joules

(b) Given: $P = 1000 \text{ W}$, $V = 220 \text{ V}$, $t = 2 \text{ hours}$

(i) Current: $I = P/V = 1000/220 = 4.55 \text{ A}$

(ii) Resistance: $R = V/I = 220/4.55 = 48.35 \Omega$

Or $R = V^2/P = (220)^2/1000 = 48.4 \Omega$

(iii) Heat generated in 2 hours:

$$t = 2 \text{ hours} = 2 \times 3600 = 7200 \text{ seconds}$$

$$H = Pt = 1000 \times 7200 = 7,200,000 \text{ J} = 7.2 \times 10^6 \text{ J}$$

Or in commercial units: Energy = $1000 \text{ W} \times 2 \text{ h} = 2 \text{ kWh} = 2 \text{ units}$

SECTION E - Answers to Case Study Based Questions

Ans 19.

(a) Household appliances are connected in parallel because:

- Each appliance gets the same voltage (220 V)
- Each appliance can be operated independently
- If one appliance fails, others continue to work

(b) Current drawn by each appliance (Using $I = P/V$):

- 100 W bulb: $I_1 = 100/220 = 0.45 \text{ A}$
- 60 W bulb: $I_2 = 60/220 = 0.27 \text{ A}$
- 1000 W iron: $I_3 = 1000/220 = 4.55 \text{ A}$

(c) Total current from main supply:

$$I = I_1 + I_2 + I_3 = 0.45 + 0.27 + 4.55 = 5.27 \text{ A}$$

Ans 20.

(a) Using first set of readings: $V = 1.5 \text{ V}$, $I = 0.3 \text{ A}$

$$R = V/I = 1.5/0.3 = 5 \Omega$$

(All sets give the same value of resistance = 5Ω)

(b) Yes, this experiment verifies Ohm's law because:

- The ratio V/I is constant ($= 5 \Omega$) for all readings
- This shows that V is directly proportional to I
- The resistance remains constant despite changes in voltage and current

(c) The V-I graph will be a straight line passing through the origin, showing that $V \propto I$.

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