

EDUVISTA • BOARD MASTER SERIES

ELECTRICITY

Class 10 Science • Chapter 11

Concept clarity + NCERT sequence + exam-ready formulas
+ 10-year PYQ coverage (2016–2025 window) + numerical
strategy

CONCEPT MAP

FORMULA VAULT

PYQ MASTER BANK

EXAM TRAPS

ONE-STOP REVISION MATERIAL

Structured from the supplied NCERT Electricity chapter.

PYQ section is concept-deduplicated so repeated questions become one powerful practice family.

2021: no regular Class X board examination was conducted; marked separately.

Prepared by Abhishek Sir • EDUVISTA

01 • MASTER ROADMAP

Study order:

1 Concept 2 Formula 3 Diagram

A. ELECTRIC CURRENT

Charge flow $\rightarrow I = Q/t \rightarrow$ unit ampere $\rightarrow$ conventional current is opposite to electron flow.

4 NCERT examp 5 PYQ 6 Timed practice

B. POTENTIAL DIFFERENCE

Why charge moves $\rightarrow$ electric pressure analogy $\rightarrow V = W/Q \rightarrow$ volt $\rightarrow$ voltmeter in parallel.

C. OHM'S LAW

At constant temperature: $V \propto I \rightarrow V = IR \rightarrow$ slope/graph logic $\rightarrow$ resistance in ohm.

D. RESISTANCE & RESISTIVITY

R depends on length, area and material $\rightarrow R = \rho l/A \rightarrow$ resistivity is material property.

E. RESISTOR COMBINATIONS

Series: same current, voltages add, $R = \Sigma R$.
Parallel: same voltage, currents add, $1/R = \Sigma(1/R)$.

F. HEATING + POWER

$H = VIt = I^2Rt$; $P = VI = I^2R = V^2/R$; 1 kWh = 3.6×10^6 J.

02 • CURRENT + POTENTIAL DIFFERENCE + CIRCUIT

ELECTRIC CURRENT

Meaning: rate of flow of electric charge through a cross-section.

Formula: $I = Q/t$

SI unit: ampere (A)

1 A = 1 C/s; 1 mA = 10^{-3} A; 1 μ A = 10^{-6} A.

Direction: conventional current is opposite to electron flow.

POTENTIAL DIFFERENCE

Why current flows: a potential difference acts like an electrical pressure difference.

Formula: $V = W/Q$

1 volt: 1 J work per 1 C charge.

Voltmeter: connected in parallel.

CIRCUIT ESSENTIALS

Closed conducting path → current can flow.
Open/broken circuit → current stops.

Ammeter: series connection; low resistance.

Voltmeter: parallel connection; high resistance.

MUST-KNOW SYMBOL LOGIC

Cell → source of potential difference.

Battery → combination of cells.

Switch/key → opens/closes circuit.

Resistor → offers resistance.

Rheostat → variable resistance/current control.

NCERT QUICK NUMERICAL

Given: $I = 0.5$ A, $t = 10$ min = 600 s.

$Q = It = 0.5 \times 600 = 300$ C.

Second template: $W = VQ$. If $V = 12$ V and $Q = 300$ C → $W = 360$ J.

Source: supplied NCERT chapter, pp. 1-4; see the circuit diagram and meter-connection discussion.

03 • OHM'S LAW + RESISTANCE

OHM'S LAW

Statement: At constant temperature, potential difference across a metallic conductor is directly proportional to current.

$$V \propto I \rightarrow V/I = \text{constant} = R \rightarrow V = IR$$

$$R = V/I; I = V/R$$

Unit of R = ohm (Ω).

V-I GRAPH

For an ohmic metallic conductor at constant temperature: straight line through origin.

Graph insight: in a V-I graph, slope = $V/I = R$.
Larger resistance $\rightarrow$ steeper V-I slope.

RESISTANCE = OPPOSITION

Electrons are not completely free inside a conductor; their motion is retarded by interactions in the material.

Low resistance $\rightarrow$ better conductor.

Higher resistance $\rightarrow$ poorer conductor.

RHEOSTAT

A variable resistance used to regulate current without changing the voltage source.

Exam phrase: changing R changes I because $I = V/R$ when V is fixed.

BOARD-READY ANSWER FRAME

Law $\rightarrow$ condition $\rightarrow$ equation $\rightarrow$ graph/diagram $\rightarrow$ conclusion. Never write only $V = IR$ for a 2-3 mark conceptual question.

04 • RESISTIVITY + FACTORS

CORE RELATION

$$R = \rho l/A$$

$R \propto l \rightarrow$ longer wire = more resistance.

$R \propto 1/A \rightarrow$ thicker wire = less resistance.

ρ = resistivity; SI unit $\Omega \text{ m}$.

THREE FACTORS

Resistance depends on:

- ① length of conductor
- ② area of cross-section
- ③ nature of material

Resistivity is a characteristic property of the material (at a specified temperature).

STRETCHING TRICK

If a wire is stretched and its volume is treated as constant:

$l \uparrow \rightarrow A \downarrow \rightarrow R$ rises sharply.

For length doubled: A becomes half $\rightarrow R$ becomes $4R$.

Resistivity does not change merely because dimensions change.

MATERIAL MEMORY

Metals/alloys have relatively low resistivity; rubber/glass are very high-resistivity materials.

Nichrome/alloys are used in heating elements because alloys generally have higher resistivity and do not oxidise readily at high temperatures.

PYQ PATTERN

Typical asks: compare two wires $\rightarrow$ derive/use $R = \rho l/A \rightarrow$ find $\rho \rightarrow$ predict change after stretching $\rightarrow$ choose minimum R from diameter/length options.

05 • SERIES vs PARALLEL — NEVER CONFUSE

SERIES

Same current: $I = I_1 = I_2 = I_3$
 Voltage adds: $V = V_1 + V_2 + V_3$
 Equivalent: $R_s = R_1 + R_2 + R_3$

R_s is greater than every individual resistor.

PARALLEL

Same voltage: $V = V_1 = V_2 = V_3$
 Current adds: $I = I_1 + I_2 + I_3$
 Equivalent: $1/R_p = 1/R_1 + 1/R_2 + 1/R_3$

R_p is less than the smallest branch resistance.

WHY HOMES USE PARALLEL

Appliances can draw different currents while receiving the same supply voltage.
 Failure of one branch need not stop the others.

EXAM ALGORITHM

1. Redraw circuit cleanly.
2. Mark series/parallel groups.
3. Reduce one group at a time.
4. Find total R.
5. Use $I = V/R$.
6. Back-substitute branch values.

FAST RATIOS

Two equal R in series $\rightarrow 2R$. Two equal R in parallel $\rightarrow R/2$. Four equal R: series = $4R$; parallel = $R/4$.

06 • HEATING EFFECT + POWER + ENERGY

JOULE'S LAW

$$H = VIt = I^2Rt$$

Heat $\propto I^2$ for fixed R.

Heat $\propto R$ for fixed I.

Heat $\propto t$ for fixed I and R.

Heating applications: iron, heater, toaster, kettle, oven, etc.

ELECTRIC POWER

$$P = VI$$

Using Ohm's law:

$$P = I^2R = V^2/R$$

SI unit: watt (W).

Power = rate of electrical energy transfer.

COMMERCIAL ENERGY

$$1 \text{ unit} = 1 \text{ kWh}$$

$$1 \text{ kWh} = 3.6 \times 10^6 \text{ J}$$

$$\text{Energy in kWh} = \text{Power (kW)} \times \text{time (h)}.$$

RATED APPLIANCE

At rated V and P:

$$I = P/V$$

$$R = V^2/P$$

Use these directly for bulb/iron/heater questions.

NCERT-STYLE NUMERICAL

If an iron consumes 840 W at 220 V: $I = P/V \approx 3.82 \text{ A}$; $R = V/I \approx 57.6 \Omega$. Always show formula $\rightarrow$ substitution $\rightarrow$ unit.

07 • FORMULA VAULT — LAST 15 MINUTES

Current

A

$$I = Q/t$$

Charge

C

$$Q = It$$

Potential difference

V

$$V = W/Q$$

Work / energy

J

$$W = VQ$$

Ohm's law

—

$$V = IR$$

Resistance Ω

$$R = V/I$$

Resistivity $\Omega \text{ m for } \rho$

$$R = \rho l/A$$

Series Ω

$$R_s = R_1 + R_2 + R_3$$

Parallel Ω

$$1/R_p = 1/R_1 + 1/R_2 + 1/R_3$$

Power

W

$$P = VI = I^2R = V^2/R$$

Heat

J

$$H = VIt = I^2Rt$$

Electrical energy

J

$$E = Pt$$

Commercial unit

J

$$1 \text{ kWh} = 3.6 \times 10^6 \text{ J}$$

UNIT CHECK: minutes → seconds, mA → A, mm → m, kW → W before substitution.

08 • 10-YEAR PYQ MAP — WHAT KEEPS RETURNING

Pattern map (2016-2025 source window; repeated concepts consolidated)



IMPORTANT INTERPRETATION

This is a pattern map, not a prediction or official CBSE chapter-wise weightage. The indexed PYQ bank repeatedly shows the same families: equivalent resistance, appliance power, resistivity/geometry, Ohm's law, heating and circuit analysis.

Sources cross-checked: CBSE question-paper archive; chapter-wise PYQ compilations; supplied NCERT chapter.

09 • PYQ MASTER BANK A — 2016-2019

2016

- Explain why rubber gloves are used by electricians.
- Connect two resistors to obtain maximum current; justify the arrangement.
- Find V for a 5 A current through an $18\ \Omega$ appliance.
- Define resistance and its unit; predict current change for a thicker wire.
- Use $\rho = RA/l$ to calculate wire length.
- Derive equivalent resistance for three resistors in series and in parallel.
- Use a V - I graph to compare heating/power of two wires.

2017

- Why is nichrome suitable for heater elements?
- Derive the equivalent-resistance relation for resistors in parallel.

2018

- Arrange three equal $9\ \Omega$ resistors to obtain $13.5\ \Omega$ and $6\ \Omega$.
- State Joule's law of heating.
- Explain why metals conduct better than glass.

2019

- Identify resistance order from V - I graphs.
- Define 1 volt and state Ohm's law.
- Find branch currents and total resistance in a mixed/parallel circuit.
- Derive $P = VI = V^2/R = I^2R$.
- Derive series and parallel equivalent-resistance relations.
- Use $\rho = RA/l$ in a wire numerical.
- Draw circuit with cells, resistors, ammeter and voltmeter; calculate readings.
- Calculate heat/power in an electric lamp or resistor.

Questions are paraphrased and consolidated from indexed PYQ records; solve the concept, not just the wording.

10 • PYQ MASTER BANK B — 2020-2022

2020

- Find maximum resistance using equal resistors.
- Interpret a nichrome V-I graph and draw the verification circuit.
- Apply $H = I^2Rt$ / VIt to a charge-transfer problem.
- Series bulbs: identify current through the second bulb.
- Find number of parallel resistors needed for a required line current.
- Use $R = \rho l/A$ for a cylindrical conductor.
- Predict heating change when resistance is halved.
- Assertion-reason: alloys in heating devices; temperature effect on resistance.
- Find bulb resistance, monthly energy and electricity cost.

2021

- No regular Class X board examination was conducted; CBSE cancelled the exam in April 2021.
- The indexed chapter bank contains a repeated power/parallel-lamps question used in some PYQ compilations, but it should not be treated as a normal full 2021 board paper.

2022

- State Ohm's law and define 1 Ω .
- Compare resistances of same-material cylindrical conductors.
- List factors affecting resistance and find wire length from ρ .
- Reduce a circuit to its equivalent resistance.
- Use series/parallel combinations to find ammeter current.
- State Joule's law and calculate heat/energy.
- Calculate resistance/current of a rated heater.
- Calculate kWh and joules for an electric kettle.
- Derive P in terms of V and R; solve a numerical.

2021 note is based on CBSE's official cancellation notification.

11 • PYQ MASTER BANK C — 2023-2025

2023

- Choose correct relations among Q , I , t and W , V .
- Verify Ohm's law with a labelled circuit; explain low ammeter resistance.
- Compare V - I graphs for series and parallel combinations.
- Define power and convert kWh to joules.
- Calculate monthly energy cost from appliance ratings.
- Find series/parallel resistance ratio for identical resistors.
- Read a voltmeter scale/least count.
- Find current and resistance of an iron at two power settings.
- State heating effect and derive heat expression.

2024

- Arrange three $6\ \Omega$ resistors for $9\ \Omega$.
- Calculate power in a specified resistor from a circuit.
- Find oven power/current/resistance from energy consumption.
- Derive/use resistivity relation and find ρ .
- Read resistance order from I - V graphs.
- Use Ohm's law in a circuit to find a resistor voltage.
- Choose wire geometry giving minimum resistance.
- Explain fuse operation and test a heater against a circuit rating.
- Find equivalent resistance in parallel/mixed networks.
- Analyse a multi-LED domestic circuit case study.
- Calculate charge-source discharge time.
- Series circuit: ammeter and voltmeter readings.

2025

- Find equivalent resistance after a wire is divided lengthwise into three equal parts and connected in parallel.
- Find filament resistance of a 220 V, 11 W bulb.
- Predict new resistance when a wire is stretched to $3l$.
- Find power when a 220 V bulb draws 500 mA.
- Find minimum number of 4 V, 6 W bulbs for a 240 V supply in series.
- Domestic circuit case: wire colours, current rating for a 1 kW iron, earth-wire function/safety.

2025 items cross-checked against indexed CBSE paper reproductions; exact set/code wording can vary.

12 • NUMERICAL PLAYBOOK — 6 REPEATABLE TEMPLATES

T1 • CURRENT

Given $Q, t \rightarrow I = Q/t$. Convert minutes to seconds.

T2 • OHM

Given $V, R \rightarrow I = V/R$. Given $I, R \rightarrow V = IR$. Given $V, I \rightarrow R = V/I$.

T3 • RESISTIVITY

Given $R, l, A \rightarrow \rho = RA/l$. For diameter d , $A = \pi d^2/4$.

T4 • SERIES

Add resistances $\rightarrow$ find $I = V/R_s \rightarrow$ voltage across each = IR .

T5 • PARALLEL

Voltage same across branches $\rightarrow I_1 = V/R_1$ etc. $\rightarrow$ total $I = \text{sum}$.

T6 • POWER/HEAT

$P = VI$; choose $P = I^2R$ or V^2/R . Heat: $H = Pt = I^2Rt$.

5-STEP BOARD NUMERICAL FORMAT

1. Given $\rightarrow$ 2. Formula $\rightarrow$ 3. Unit conversion $\rightarrow$ 4. Substitution $\rightarrow$ 5. Final answer with unit.
For circuit questions, add a small reduction diagram. For derivations, write each equation on a separate line.

13 • BOARD ANSWER ENGINE + COMMON TRAPS

2-MARK ANSWER

Definition/statement + one formula or one reason.

Example: "Potential difference is work done per unit charge." Then write $V=W/Q$ and unit volt.

3-MARK ANSWER

Concept → equation → calculation/diagram → conclusion.

Do not skip units or the condition of Ohm's law (constant temperature).

TRAP 01

Ammeter is series, voltmeter is parallel.
Do not reverse them in circuit diagrams.

TRAP 02

Series → current same.
Parallel → voltage same.
Equivalent R: series increases; parallel decreases.

TRAP 03

Use SI units before substitution.

TRAP 04

Rated appliance: $R=V^2/P$, $I=P/V$.

14 • FINAL 1-PAGE REVISION CHECKLIST

✓	I can define electric current and write $I=Q/t$.	Current
✓	I can explain conventional current vs electron flow.	Current
✓	I can define 1 volt and use $V=W/Q$.	Potential
✓	I can draw a correct circuit with cell, key, resistor, A and V.	Circuit
✓	I can state Ohm's law and interpret a V-I graph.	Ohm
✓	I can use $R=\rho l/A$ and handle diameter/area.	Resistivity
✓	I can solve series and parallel combinations.	Networks
✓	I can derive/use $P=VI$, I^2R , V^2/R .	Power
✓	I can use $H=I^2Rt$ and $H=VIt$.	Heating
✓	I can convert kWh $\leftrightarrow$ J and calculate energy cost.	Energy
✓	I can solve mixed-network PYQs step-by-step.	PYQ
✓	I can explain fuse/earth wire/domestic safety.	Application

EDUVISTA EXAM MANTRA

Understand the circuit → choose the formula → keep units clean → show working → box the final answer.