Class 12 Physics Chapter 2 Current Electricity NCERT Solutions PDF

In physics class 12 chapter 3, you learn how electric current flows in a wire, how resistance works, and how batteries and circuits behave. These class 12 physics chapter 3 notes and chapter 3 physics class 12 **NCERT solutions** will help you understand every idea in very simple words. With these ncert solutions for class 12 physics chapter 3, you can solve all important sums and get exam confidence. Use these physics chapter 3 class 12 notes and class 12 physics chapter 3 exercise solutions daily to score better marks.

Read About: Class 12 Physics Chapter 1 Electric Charges and Fields

Class 12 Physics Chapter 3 Current Electricity Sub Topics

This table shows each sub-topic as a small story and what you mainly learn from it.

Sub-topic	**Story / Concept Name**	**Main Learning / Moral**
Electric Current	Flowing Water	Current is the rate of flow of charge in a wire.
Electric Currents in Conductors	Busy Road	Many electrons move together through metal like cars on a road.
Ohm's law	Simple Rule	Current, voltage and resistance are linked by a simple rule.

Drift of Electrons and Resistivity	Slow Walk	Electrons drift slowly and this drift causes resistance in a wire.
Limitations of Ohm's Law	Rule Not Always Works	Ohm's law does not hold for all materials and all conditions.
Resistivity of Various Materials	Material Friends	Different materials oppose current in different amounts.
Temperature Dependence of Resistivity	Hot and Cold Wire	Resistance changes when the wire becomes hot or cold.
Electrical Energy, Power	Work Done by Current	Current can do work and consume power in a device.
Cells, emf, Internal Resistance	Real Battery Story	Real cells have emf and also some internal resistance inside.
Cells in Series and in Parallel	Battery Teamwork	Cells can be joined in different ways to get needed voltage or current.
Kirchhoff's Rules	Traffic Rules	Simple rules to solve complex circuit loops and junctions.

Wheatstone Bridge	Accurate Balance	A special bridge circuit to find unknown resistance very accurately.

Read About: Class 12 Physics Chapter 2 Electrostatic Potential and Capacitance

NCERT Solution for Class 12 Physics Chapter 3

Below are easy and detailed class 12 physics chapter 3 exercise solutions for the given questions. Equations are written in plain text so you can copy paste directly.

Q1. The storage battery of a car has an emf of 12 V. If the internal resistance of the battery is 0.4 Ω, what is the maximum current that can be drawn from the battery?

Given:
emf E = 12 V
internal resistance r = 0.4 ohm

Maximum current means the terminals are shorted, so external resistance R = 0.
Use Ohm's law for the whole battery:
I = E / (R + r)

Here R = 0, so
I = E / r
I = 12 / 0.4
I = 30 A

Answer: Maximum current that can be drawn is 30 A.

Q2. A battery of emf 10 V and internal resistance 3 Ω is connected to a resistor. If the current in the circuit is 0.5 A,

(a) what is the resistance of the resistor?

(b) what is the terminal voltage of the battery when the circuit is closed?

Given:
E = 10 V

r = 3 ohm
current I = 0.5 A

(a) Total resistance in circuit:
R_total = E / I
R_total = 10 / 0.5 = 20 ohm

But
R_total = R + r
So
R + 3 = 20
R = 20 - 3 = 17 ohm

(b) Terminal voltage V across external resistor:
V = E - I * r
V = 10 - (0.5 * 3)
V = 10 - 1.5 = 8.5 V

Answer: Resistor is 17 ohm, terminal voltage is 8.5 V.

3. At room temperature (27.0 °C) the resistance of a heating element is 100 Ω. What is the temperature of the element if the resistance is found to be 117 Ω, given that the temperature coefficient of the material is 1.70 × 10–4 °C–1?

Given:
R0 = 100 ohm at T0 = 27 °C
R = 117 ohm at T = ?
alpha = 1.70e-4 per degree C

Use formula for resistance with temperature:
R = R0 * (1 + alpha * (T - T0))

So:
117 = 100 * (1 + alpha * (T - 27))
Divide both sides by 100:
1.17 = 1 + alpha * (T - 27)

So:
alpha * (T - 27) = 1.17 - 1 = 0.17

Thus:
T - 27 = 0.17 / alpha
T - 27 = 0.17 / (1.70e-4)

0.17 / 1.70e-4 = 0.17 / 0.00017 = 1000

So:
T = 27 + 1000 = 1027 °C

Answer: The temperature of the element is 1027 °C.

4. A negligibly small current is passed through a wire of length 15 m and uniform cross-section 6.0 × 10–7 m², and its resistance is measured to be 5.0 Ω. What is the resistivity of the material?

Given:
R = 5 ohm
length l = 15 m
area A = 6.0e-7 m^2

Use relation:
R = rho * l / A

So:
rho = R * A / l

Put values:
rho = 5 * (6.0e-7) / 15

First 5 * 6.0e-7 = 30e-7 = 3.0e-6

Now divide by 15:
rho = 3.0e-6 / 15 = 0.2e-6 = 2.0e-7 ohm m

Answer: Resistivity rho = 2.0 × 10^−7 ohm metre.

5. A silver wire has a resistance of 2.1 Ω at 27.5 °C, and a resistance of 2.7 Ω at 100 °C. Determine the temperature coefficient of resistivity of silver.

Given:
R1 = 2.1 ohm at T1 = 27.5 °C
R2 = 2.7 ohm at T2 = 100 °C

Use:
R2 = R1 * (1 + alpha * (T2 - T1))

So:
2.7 = 2.1 * (1 + alpha * (100 - 27.5))

Divide both sides by 2.1:
2.7 / 2.1 = 1 + alpha * (72.5)

2.7 / 2.1 = 27 / 21 = 9 / 7 ≈ 1.2857

So:
1.2857 = 1 + alpha * 72.5

Thus:
alpha * 72.5 = 1.2857 - 1 = 0.2857

alpha = 0.2857 / 72.5

alpha ≈ 3.94e-3 per degree C (about 3.9 × 10^−3 °C^−1)

Answer: Temperature coefficient alpha ≈ 3.9 × 10^−3 °C^−1.

6. A heating element using nichrome connected to a 230 V supply draws an initial current of 3.2 A which settles after a few seconds to a steady value of 2.8 A. What is the steady temperature of the heating element if the room temperature is 27.0 °C? Temperature coefficient of resistance of nichrome (average) is 1.70 × 10−4 °C−1.

Given:
Supply voltage V = 230 V
Initial current I1 = 3.2 A at T1 = 27 °C
Final current I2 = 2.8 A at T2 = ?
alpha = 1.70e-4 per degree C

First find initial and final resistances using R = V / I.
Initial resistance R1:
R1 = V / I1 = 230 / 3.2

R1 ≈ 71.875 ohm

Final resistance R2:
R2 = V / I2 = 230 / 2.8

R2 ≈ 82.14 ohm

Use temperature relation:
R2 = R1 * (1 + alpha * (T2 - T1))

So:
82.14 = 71.875 * (1 + alpha * (T2 - 27))

Divide both sides by 71.875:
82.14 / 71.875 ≈ 1.1427

So:
1.1427 = 1 + alpha * (T2 - 27)

Thus:
alpha * (T2 - 27) = 0.1427

T2 - 27 = 0.1427 / alpha

T2 - 27 = 0.1427 / (1.70e-4)

0.1427 / 1.70e-4 ≈ 839 (approx)

So:
T2 ≈ 27 + 839 ≈ 866 °C

Answer: The steady temperature of the element is about 866 °C.

7. storage battery of emf 8.0 V and internal resistance 0.5 Ω is being charged by a 120 V dc supply using a series resistor of 15.5 Ω.
(a) What is the terminal voltage of the battery during charging?
(b) What is the purpose of having a series resistor in the charging circuit?

Given:
Supply voltage Vs = 120 V
Battery emf E = 8 V
Internal resistance r = 0.5 ohm
Series resistor Rs = 15.5 ohm

Total series resistance in charging path:
R_total = Rs + r = 15.5 + 0.5 = 16 ohm

Charging current I:
$I = (Vs - E) / (Rs + r)$

$I = (120 - 8) / 16$
$I = 112 / 16 = 7$ A

(a) Terminal voltage of the battery while charging:
When charging, terminal voltage Vb is greater than E:
$Vb = E + I * r$

$Vb = 8 + 7 * 0.5$
$Vb = 8 + 3.5 = 11.5$ V

(b) Purpose of series resistor:
The series resistor limits the current to a safe value so that the battery is not damaged by too large charging current. It protects the battery and the circuit.

Answer: Terminal voltage is 11.5 V; the series resistor is there to limit and control the charging current.

8. The number density of free electrons in a copper conductor is 8.5 × 10^28 m–3. How long does an electron take to drift from one end of a wire 3.0 m long to its other end? The area of cross-section of the wire is 2.0 × 10–6 m² and it is carrying a current of 3.0 A.

Given:
Number density n = 8.5e28 per m^3
Length of wire l = 3.0 m
Area A = 2.0e-6 m^2
Current I = 3.0 A
Charge of electron e = 1.6e-19 C

Use relation between current and drift velocity:
$I = n * e * A * v_d$

So drift velocity:
$v_d = I / (n * e * A)$

Put values:
$v_d = 3.0 / (8.5e28 * 1.6e-19 * 2.0e-6)$

First multiply the denominator:
1.6e-19 * 2.0e-6 = 3.2e-25

Now 8.5e28 * 3.2e-25 = 27.2e3 = 2.72e4

So:
v_d = 3.0 / (2.72e4)

v_d ≈ 1.10e-4 m/s (about 1.1 × 10^−4 m/s)

Time taken to drift length l:
t = l / v_d

t = 3.0 / (1.10e-4)

t ≈ 2.73e4 s

This is about 2.7 × 10^4 seconds, which is roughly 7.6 hours.

Answer: The electron takes about 2.7 × 10^4 s (about 7.5 hours) to drift from one end to the other.

Physics Class 12 Chapter 3 Current Electricity Summary

Below are short, clear physics chapter 3 class 12 notes for each sub-topic.

- Electric Current: Current is the rate at which charge flows through a cross-section of a wire. Simple idea: more charge per second means more current.
- Electric Currents in Conductors: In metals, free electrons move when a voltage is applied. These tiny charges drift slowly, but the effect of current is seen quickly.
- Ohm's Law: At constant temperature, current I in a conductor is proportional to voltage V. The rule is written as V = I * R, where R is resistance.
- Drift of Electrons and Origin of Resistivity: Electrons collide with atoms as they move, so they drift slowly. These collisions cause resistivity and make the wire oppose current.
- Limitations of Ohm's Law: Some materials do not follow V proportional to I (for example, diodes, filament at high temperature). For such devices, the V-I graph is not a straight line.
- Resistivity of Various Materials: Metals have low resistivity, alloys have higher, and insulators have very high resistivity. This helps us choose proper materials for wires and resistors.

- Temperature Dependence of Resistivity: In metals, resistance usually increases with temperature. In some materials like semiconductors, resistance can decrease when heated.
- Electrical Energy and Power: When current flows, it does work and converts electric energy into heat, light etc. Power P is given by P = V * I or P = I^2 * R.
- Cells, emf, Internal Resistance: A cell has emf E, which is its ideal voltage. It also has internal resistance r, so the terminal voltage becomes less when current flows.
- Cells in Series and in Parallel: Series connection increases total emf, while parallel connection makes the system supply more current with lower internal resistance.
- Kirchhoff's Rules: Junction rule says total current into a junction equals total current out. Loop rule says the sum of voltage gains and drops in a loop is zero.
- Wheatstone Bridge: This is a special arrangement of four resistors to find an unknown resistance using a balance condition, without large current in the measuring device.

Connecting note: Together, these ideas show how current flows, how circuits behave, and how to design safe, useful electrical systems. Once you understand this chapter, many later topics in electricity and electronics become easy.

How to Learn Current Electricity Class 12 Physics Chapter 3 Easily

Here are some simple ways to learn and revise chapter 3 physics class 12.

- **Break into small topics:** Study one sub-topic at a time like Ohm's law, resistivity, then cells, then Kirchhoff's rules. This keeps you relaxed and focused.
- **Make a formula sheet:** Write all key formulas such as V = I * R, R = rho * l / A, and I = n * e * A * v_d on one page. Use this sheet daily before tests.
- **Solve all examples and exercises:** Do each class 12 physics chapter 3 exercise solution step by step. This will make you fast and confident in numerical questions.
- **Explain in your own words:** After reading class 12 physics chapter 3 notes, try to tell the concept to a friend or to yourself in simple language. If you can explain, you have understood.
- **Connect with real life:** Look at bulbs, heaters, and batteries at home and think which formula fits. Linking theory to real things makes learning strong and long-lasting.

Physics Class 12 Chapter 3 FAQs

Q1. How many main sub-topics are there in current electricity chapter?

Ans: There are around 12 main sub-topics including electric current, Ohm's law, resistivity, cells, Kirchhoff's rules, and Wheatstone bridge.

Q2. What is the main idea of this chapter?

Ans: The main idea is to explain how charges move in circuits, how resistance and voltage affect current, and how to use rules to solve circuit problems.

Q3. Which concepts are most important for exams?

Ans: Ohm's law, temperature dependence of resistance, cell emf and internal resistance, series and parallel combinations, and Kirchhoff's rules are very important.

Q4. How can class 12 physics chapter 3 ncert solutions help me?

Ans: They show step-by-step methods for all questions so you can learn the right approach, avoid silly mistakes, and score high marks.

Q5. Are physics chapter 3 class 12 notes and pdf enough for board exams?

Ans: If you study the notes, learn all formulas, and practice all exercise solutions from the pdf, you will be well prepared for board exam questions from this chapter.