⚙ UNIT 1: ELECTRICAL FUNDAMENTALS

🟦 INTRODUCTION

Every time you test a battery, check a fuse, or diagnose a bulb that's too dim, you are working with Ohm's Law—whether you know it or not. This law explains how voltage, current, and resistance are mathematically related. Understanding this relationship allows auto electricians and mechanics to predict circuit behavior, identify faults, and ensure safe operation.

🎯 LEARNING OBJECTIVES

1. Define Ohm's Law and its three main formulas.

2. Calculate voltage, current, or resistance in a circuit when two values are known.

3. Interpret Ohm's Law in real-world automotive situations like battery testing, lighting, and fuse checking.

📐 SECTION 1: WHAT IS OHM'S LAW?

- Ohm's Law is the fundamental rule of electricity that shows how voltage (V), current (I), and resistance (R) are related.

  The formula:
  - $V = I \times R$

  Where:

  V = Voltage (Volts)

  I = Current (Amperes or Amps)

  R = Resistance (Ohms, symbol: Ω)

🔄 THE TRIANGLE METHOD

- To easily remember all forms of the formula, use the Ohm's Triangle:

  V

  I × R

  Cover what you need to find:

  V = I × R

  I = V ÷ R

  R = V ÷ I

🔧 SECTION 2: HOW OHM'S LAW APPLIES IN AUTO SERVICING

Scenario	Use of Ohm's Law
Headlights are dim	Measure voltage and check resistance in wires to ensure correct current flow.
Fuse keeps blowing	Too much current? Calculate I to determine the right fuse rating.
Blower motor weak	Check voltage drop and resistance to verify if the circuit is restricted.
Battery test	Confirm that voltage and current output are balanced under load.

🧠 SECTION 3: PRACTICAL EXAMPLES

- Find the Current (I):
  A 12V battery is powering a headlight with 3Ω resistance.
  👉 I = V ÷ R = 12 ÷ 3 = 4 Amps

  Find the Resistance (R):
  A heater draws 6A from a 12V circuit.
  👉 R = V ÷ I = 12 ÷ 6 = 2 Ohms

  Find the Voltage (V):
  A circuit has 5A flowing through a 2Ω resistor.
  👉 V = I × R = 5 × 2 = 10 Volts

🔍 SECTION 4: TIPS FOR SOLVING OHM'S LAW PROBLEMS

Always use the same unit system: Volts (V), Amps (A), Ohms (Ω)

- Watch for decimal places when using small currents or low resistance.

- Double-check real measurements with your math—if the numbers don't make sense, re-measure.

🎥 RECOMMENDED VIDEO

Video: "Ohm's Law Explained for Beginners – Automotive Focus"

YouTube Channel: Learn Engineering or similar

Source: https://www.youtube.com/watch?v=Z3AxiDATC0s

Covers:

- Visual circuit examples

- Troubleshooting based on Ohm's Law

- Application to fuses, relays, lights, and loads

⚠️ COMMON MISTAKES TO AVOID

Mistake	Clarification
Swapping I and R	Always label values before plugging into the formula
Forgetting units	Always write answers with Volts, Amps, or Ohms
Overlooking total resistance	In complex circuits, combine resistances before solving

🧰 TOOLS USED TO APPLY OHM'S LAW IN THE SHOP

- Multimeter – for measuring voltage, current, and resistance

- Clamp meter – for measuring current without disconnecting wires

- Test light – basic voltage presence test

- Wiring diagram – helps identify points in the circuit to test

✅ SUMMARY – KEY POINTS

- Ohm's Law (V = I × R) links voltage, current, and resistance.

  You can find any of the three values if you know two.

  It is essential for diagnosing electrical problems like dim lights, blown fuses, or power loss.

  Used every day when testing batteries, lighting circuits, sensors, and relays.

REFERENCES

- Auto Electrical System Module – Competency-Based Learning Material
  https://www.scribd.com/document/601714455/Auto-Electrical-System-Module-PDF

  TESDA Training Regulations – Automotive Servicing NC II
  https://www.tesda.gov.ph

  YouTube – Ohm's Law Explained (Beginner Friendly)
  https://www.youtube.com/watch?v=Z3AxiDATC0g