Teacher: Sayan Chakraborti   Student:

Understanding Electrical Power and Energy

Objective
To learn about the concepts of electrical power and energy, understand how to calculate power, and explore the implications of these calculations in everyday life.

1. What is Electrical Power?
Definition: Electrical power is the rate at which electrical energy is transferred by an electric circuit. It tells us how quickly energy is being used or generated.

SI Unit: The standard unit of power is the Watt (symbol: W), named after James Watt, the 18th-century developer of the steam engine. Defined as one joule of energy transferred per second. In terms of electricity, a watt is the power produced by a current of one ampere flowing through an electric potential of one volt.

2. Expressions for Power:
Power in terms of voltage and current:

$$P = IV$$

Where P is power in watts, I is current in amperes, and V is voltage in volts.

Power in terms of resistance and current:

$$P = I^2 R$$

This formula shows that power is also related to the square of the current times the resistance in ohms.

3. What is Electrical Energy?
Definition: Electrical energy is the energy derived from electric potential energy or kinetic energy. It's what powers our electronic devices and appliances.
Calculating Energy Usage:

Energy (in watt-hours, Wh) can be calculated as Power (W) × Time (hours).

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In-Class Problems

Problem 1: Calculating Power Usage

Scenario: A light bulb is rated at 60W and is used for 2 hours every day. Calculate the energy used by the light bulb in one day.

Problem 2: Understanding Energy Consumption

Question: If an electric oven uses 2,000 watts of power and operates for 3 hours, how much energy (in watt-hours) does it consume?

Problem 3: Comparing Power Requirements

Scenario: Two devices are connected to a 9V battery. Device A draws 0.5 amperes of current, and Device B draws 0.75 amperes. Which device uses more power, and by how much?