Module 4 · Week 35 · Lesson

Series and Parallel Circuits

PH11-11, PH11-6

ORIENTATION

Lesson goal: analyse current, voltage, and equivalent resistance in series, parallel, and combined circuits.

Students should read the circuit structure before substituting into equations.

CORE CONTENT

Series resistors:

$$R_s = R_1 + R_2 + \dots$$

Parallel resistors:

$$\frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2} + \dots$$

Kirchhoff's laws:

$$\sum I_{\text{in}} = \sum I_{\text{out}}$$

$$\sum \Delta V_{\text{loop}} = 0$$

CIRCUIT TYPE	CURRENT	VOLTAGE	RESISTANCE
series	same through components	divides across components	adds

CIRCUIT TYPE	CURRENT	VOLTAGE	RESISTANCE
parallel	splits between branches	same across branches	reciprocal sum; lower than smallest branch

CONCEPT CHECK

1. In a series circuit, current is:

    - A. the same through each component
    - B. zero after the first resistor
    - C. larger after each resistor
    - D. unrelated to the circuit

    Answer: A.

2. In a parallel circuit, voltage across each branch is:

    - A. the same
    - B. always zero
    - C. split equally regardless of resistance
    - D. impossible to measure

    Answer: A.

3. An ammeter should be connected:

    - A. in series
    - B. in parallel only
    - C. across the battery only
    - D. not in a circuit

    Answer: A.

APPLIED PRACTICE

A `12 V` source is connected to a `3 ohm` resistor in series with a parallel pair of `6 ohm` and `12 ohm` resistors.

1. Parallel section:

$$R_p = \left(\frac{1}{6} + \frac{1}{12}\right)^{-1} = 4\ \Omega$$

2. Total resistance:

$$R_{\text{eq}} = 3 + 4 = 7\ \Omega$$

3. Total current:

$$I = \frac{12}{7} = 1.71\ \text{A}$$

Final answer: total current is $1.71\ \text{A}$.

DEEP PRACTICE AND WRITING

Prompt: explain why a parallel equivalent resistance is lower than any single branch resistance.

MAINTENANCE LOOP

One circuit sketch: identify series/parallel groups, meter placement, and which quantity is shared.

STUDENT WORKING