Practical Circuit Applications

PH11-6, PH11-7, PH11-11

ORIENTATION

Lesson goal: apply circuit concepts to power, energy transfer, safety devices, and household-style circuit reasoning.

This is not a lab manual yet. It is the conceptual and calculation layer that the later lab sheets should attach to.

CORE CONTENT

Electrical power is the rate of energy transfer:

$$P = VI$$

$$E = Pt$$

For resistive devices:

$$P = I^2R = \frac{V^2}{R}$$

Safety devices are designed around current, heating, and fault pathways.

DEVICE OR FEATURE	PHYSICS ROLE
fuse	melts when current is excessive
circuit breaker	opens circuit under fault condition
earth wire	provides low-resistance fault path

DEVICE OR FEATURE	PHYSICS ROLE
insulation	prevents unwanted current path
parallel household wiring	keeps appliances at supply voltage independently

CONCEPT CHECK

1. A `60 W` device transfers:

    - A. `60 J` every second
    - B. `60 C` every second
    - C. `60 V` every second
    - D. `60 ohm` every second

    Answer: A.

2. Household appliances are usually connected in parallel so that:

    - A. each receives the supply voltage
    - B. current is zero
    - C. resistance disappears
    - D. voltage is used up

    Answer: A.

3. Excess current is dangerous because it can cause:

    - A. heating
    - B. lower energy transfer
    - C. lower resistance always
    - D. no change

    Answer: A.

APPLIED PRACTICE

A heater is rated at `1200 W` and operates for `15 min`. Calculate the energy transferred.

1. Convert time:

$$15\ \text{min} = 900\ \text{s}$$

2. Use:

$$E = Pt = 1200 \times 900$$

3. Result:

$$E = 1.08 \times 10^6\ \text{J}$$

Final answer: $1.08\ \text{MJ}$.

DEEP PRACTICE AND WRITING

Prompt: explain why a fuse must be placed in series with the appliance and how it reduces risk during excessive current.

MAINTENANCE LOOP

Retrieve $P = VI$, $E = Pt$, and one safety-device mechanism.

STUDENT WORKING