CALCULATING CURRENT

Ohm's Law states that \( I = \frac{V}{R} \)

where \( I = \) current (amperes)
\( V = \) voltage (volts)
\( R = \) resistance (ohms)

Solve the following problems.

1. What is the current produced with a 9-volt battery through a resistance of 100 ohms?

2. Find the current when a 12-volt battery is connected through a resistance of 25 ohms.

3. If the potential difference is 120 volts and the resistance is 50 ohms, what is the current?

4. What would be the current in Problem 3 if the potential difference were doubled?

5. What would be the current in Problem 3 if the resistance were doubled?
## CALCULATING VOLTAGE

Formula: \[ V = I \times R \]

Voltage (volts) = Current (amperes) \times Resistance (ohms)

**Solve the following problems.**

1. What voltage produces a current of 50 amps with a resistance of 20 ohms?

   \[ V = 50 \times 20 \]

2. Silver has a resistance of 1.98 x 10^{-4} \text{ ohms}. What voltage would produce a current of 100 amps?

   \[ V = 100 \times 1.98 \times 10^{-4} \]

3. A current of 250 amps is flowing through a copper wire with a resistance of 2.09 x 10^{-2} ohms. What is the voltage?

   \[ V = 250 \times 2.09 \times 10^{-2} \]

4. What voltage produces a current of 500 amps with a resistance of 50 ohms?

   \[ V = 500 \times 50 \]

5. What voltage would produce a current of 100 amps through an aluminum wire which has a resistance of 3.44 x 10^{-4} ohms?

   \[ V = 100 \times 3.44 \times 10^{-4} \]
CALCULATING RESISTANCE

\[ R = \frac{V}{I} \quad \text{Resistance (ohms)} = \frac{\text{Voltage (volts)}}{\text{Current (amperes)}} \]

Solve the following problems.

1. What resistance would produce a current of 200 amperes with a potential difference of 2,000 volts?

2. A 12-volt battery produces a current of 25 amperes. What is the resistance?

3. A 9-volt battery produces a current of 2.0 amperes. What is the resistance?

4. An overhead wire has a potential difference of 2,000 volts. If the current flowing through the wire is one million amperes, what is the resistance of the wire?

5. What is the resistance of a light bulb if a 120-volt potential difference produces a current of 0.8 amperes?
OHM'S LAW PROBLEMS

Using Ohm's Law, solve the following problems.

1. What is the current produced by a potential difference of 240 volts through a resistance of 0.2 ohms?

2. What resistance would produce a current of 120 amps from a 6-volt battery?

3. What voltage is necessary to produce a current of 200 amperes through a resistance of $1 \times 10^{-3}$ ohms?

4. What is the current produced by a 9-volt battery flowing through a resistance of $2 \times 10^{-4}$ ohms?

5. What is the potential difference if a resistance of 25 ohms produces a current of 250 amperes?
CALCULATING POWER

\[ P = V \times I \]
Power (watts) = Voltage (volts) \times current (amperes)

Solve the following problems.

1. A 6-volt battery produces a current of 0.5 amps. What is the power in the circuit?

2. A 100-watt light bulb is operating on 1.2 amperes current. What is the voltage?

3. A potential difference of 120 volts is operating on a 500-watt microwave oven. What is the current being used?

4. A light bulb uses 0.625 amperes from a source of 120 volts. How much power is used by the bulb?

5. What voltage is necessary to run a 500-watt motor with a current of 200 amperes?
CALCULATING ELECTRICAL
ENERGY AND COST

One kilowatt hour is 1,000 watts of power for one hour of time. The abbreviation for
kilowatt hour is kWh.

Example: A coffee pot operates on 2 amperes of current on a 110-volt
circuit for 3 hours. Calculate the total kWh used.

1. Determine power:  \[ P = V \times I \]
   \[ = 110 \text{ volts} \times 2 \text{ amps} \]
   \[ = 220 \text{ watts} \]

   \[ \text{kWh} = \frac{P \times \text{hours}}{1,000} \]

2. Convert watts to kilowatts:
   \[ 220 \text{ watts} \times \frac{1 \text{ kilowatt}}{1,000 \text{ watts}} = 0.22 \text{ kW} \]

3. Multiply by the hours given in the problem:
   \[ 0.22 \text{ kW} \times 3 \text{ hrs} = 0.66 \text{ kWh} \]

Solve the following problems.

1. A microwave oven operates on 5 amps of current on a 110-volt circuit for one hour. Calculate the total kilowatt hours used. 

2. How much would it cost to run the microwave in Problem 1 if the cost of energy is $0.10 per kWh? 

3. An electric stove operates on 20 amps of current on a 220-volt circuit for one hour. Calculate the total kilowatt hours used. 

4. What is the cost of using the stove in Problem 3 if the cost of energy is $0.10 per kWh? 

5. A refrigerator operates on 15 amps of current on a 220-volt circuit for 18 hours per day. How many kilowatt hours are used per day? 

6. If the electric costs are 15¢ per kWh, how much does it cost to run the refrigerator in Problem 5 per day? 

7. The meter reading on June 1 was 84502 kWh. On July 1, the meter read 87498 kWh. If the cost of electricity in the area was 12¢ per kWh, what was the electric bill for the month of June? 

8. A room was lighted with three 100-watt bulbs for 5 hours per day. If the cost of electricity was 9¢ per kWh, how much would be saved per day by switching to 60-watt bulbs?
SERIES AND PARALLEL CIRCUITS

A  
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B  
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Answer the following questions regarding circuits A and B above.

1. Label circuits A and B as series or parallel.
2. If bulb a burns out, will bulb d still light? ________________
3. If bulb f burns out, will bulb g still light? ________________
4. If bulbs b, c and d are burned out, will bulb a still light? ________________
5. If bulbs f and g are missing, will bulb e still light? ________________
6. Draw a diagram of a parallel circuit having 3 light bulbs, 3 switches and a battery. Each light bulb is on a separate switch.

7. Draw a diagram of a series circuit having 3 light bulbs, one switch and a battery.

8. Would series or parallel circuits be better for wiring light in a house? ________________
   Why? ________________
AN ELECTRIC MOTOR

Label the following parts on the picture of the electric motor below. List the function/purpose of each part.

horseshoe electromagnet (or permanent magnet) ____________________________

armature ____________________________

commutator ____________________________

brushes (+ and -) ____________________________

field coil ____________________________

current source ____________________________
TRANSFORMERS

Determine the voltage and current in the following transformers.

**Step-Up Transformer**

![Diagram of a step-up transformer with a 1:2 ratio]

- 6 volts
- 120 amps

**Step-Down Transformer**

![Diagram of a step-down transformer with a 3:1 ratio]

- 12 volts
- 120 amps

Primary Coil

Secondary Coil
ACROSS
3. Made from semiconductors and need little voltage
6. An electric ____ converts electrical energy to kinetic energy.
8. Measures current
9. Changes alternating current to direct current
11. This type of circuit may contain thousands of tiny transistors

DOWN
1. Measures potential difference
2. Current that changes direction
4. Magnifies a small electric signal
5. A device that produces current by moving a magnetic field across a wire
7. A semiconductor material
10. A device that uses electrons to produce images on a screen is a ____ ray tube.