

Math Skills

Electric Power

After you study each sample problem and solution, work out the practice problems on a separate sheet of paper. Write your answers in the spaces provided.

PROBLEM

An alarm clock uses 5.0 W of electric power. If the clock is plugged into a 120-V outlet, what electric current is in the clock's circuit?

SOLUTION

Step 1: List the given and unknown values.

Given: voltage, $V = 120 \text{ V}$

power, $P = 5.0 \text{ W}$

Unknown: current, $I = ? \text{ A}$

Step 2: Write the equation for electric power, and rearrange it to solve for current.

$$P = VI \Rightarrow I = \frac{P}{V}$$

Step 3: Insert the known values into the equation, and solve.

$$I = \frac{5.0 \text{ W}}{120 \text{ V}} = 4.2 \times 10^{-2} \text{ A}$$

PRACTICE

- The headlights of an automobile have two power ratings: 45 W for the low beam and 65 W for the high beam. How much is the current in the headlight filament of a headlight bulb for both of these settings when 12 V is provided by the car battery?

- The heating coils of an electric stove are made of a high-resistance material so that the electricity that passes through the coils causes them to become red hot within a minute. The smaller coil draws 1,250 W of power, while the larger coil draws 2,100 W. The voltage provided across each coil is 240 V. What is the current in each coil?

- An electric mixer draws 200.0 W of power. If the mixer is plugged into an outlet across a voltage of 115 V, what current is in the mixer's circuit?

- A bus built in 1905 used electricity produced by a gasoline-powered generator. The generator provided 33.6 kW of power to the bus. If the voltage across the electric motor was 440 V, what was the current in the motor?

- Alternating current is used today because its voltage can be easily changed by a device called a transformer. Transformers are used both to increase the voltage of electricity, so that it can travel long distances, and to decrease the voltage, so that the electricity can be used in your house with relative safety. If the voltage across two wires is raised to $2.5 \times 10^5 \text{ V}$, what is its current if 1.0×10^5 of power is provided?

Resistance

After you study each sample problem and solution, work out the practice problems on a separate sheet of paper. Write your answers in the spaces provided.

PROBLEM

A clothes dryer is equipped with an electric heater. The heater works by passing air across an electric wire that is hot because of the current in it. The wire's resistance is $10.0\ \Omega$, and the current in the wire equals $24\ \text{A}$. What is the voltage across the heater wire?

SOLUTION

Step 1: List the given and unknown values.

Given: resistance, $R = 10.0\ \Omega$

current, $I = 24\ \text{A}$

Unknown: voltage, $V = ?\ \text{V}$

Step 2: Write the equation for resistance, and rearrange it to solve for voltage.

$$R = \frac{V}{I}$$

$$V = IR$$

Step 3: Insert the known values into the equation, and solve.

$$V = (10.0\ \Omega) \times (24\ \text{A})$$

$$V = 240\ \text{V}$$

PRACTICE

1. A hair dryer uses a wire that is hot because of the current in it to warm the air that blows through the dryer. The resistance of this wire is $7.7\ \Omega$. If the current through the wire equals $15.6\ \text{A}$, what is the voltage across the terminals of the hair dryer?

2. A battery-powered electric lantern is used as a light source for campers. The light bulb in the lantern has a resistance of $6.4\ \Omega$. Assume the rest of the lantern's circuit has no resistance and that the current in the circuit is $0.75\ \text{A}$. Calculate the voltage across the terminals of the lantern's battery.

3. Some kitchen sinks are equipped with electric garbage disposals. These are units with rapidly rotating steel blades that crush and chop food so that it can be washed down the drain instead of taking up space as solid garbage. The motor of a garbage disposal has a resistance of about $25.0\ \Omega$. If the current in the motor is $4.66\ \text{A}$, what is the voltage across the motor's terminals?
