

Electrical Energy and Current

Problem E**ELECTRIC POWER****PROBLEM**

If an alarm clock is plugged into a 120 V outlet, the electric current in the clock's circuit is 4.2×10^{-2} A. How much power does the alarm clock use?

SOLUTION

Given: $\Delta V = 120 \text{ V}$ $I = 4.2 \times 10^{-2} \text{ A}$

Unknown: $P = ?$

Choose the equation(s) or situation:

Because the current and potential difference are given but the power is unknown, use the third form of the power equation on page 709, which includes these three variables.

$$P = I\Delta V = (4.2 \times 10^{-2} \text{ A})(120 \text{ V}) = \boxed{5.0 \text{ W}}$$

ADDITIONAL PRACTICE

1. A generator at a central electric power plant produces electricity with a potential difference of 2.5×10^4 V across power lines which carry a current of 20.0 A. How much power does the generator produce?
2. An electric sports car was developed several years ago at Texas A&M University in College Station, Texas. If the potential difference across the car's motor is 720 V and the resistance was 0.30Ω , how much power was needed for the car to run?
3. A light bulb has a filament with a resistance of 144Ω , while a second bulb has a filament with a resistance of 240Ω . Both bulbs are connected across a 120 V outlet. Which light bulb is brighter? [Hint: The brightest bulb uses the most power.]
4. A microwave oven requires 1750 W of power to cook food. If the oven is plugged into a 120 V outlet, what is the resistance in the oven's circuit?
5. A waffle iron requires 650 W of power to operate. If the waffle iron is plugged into a 120 V outlet, what is the resistance in the waffle iron's circuit?

6. An electric kettle requires 370 W of power to boil water. If the kettle is plugged into a 120 V outlet, what is the resistance in the kettle's circuit?
7. A blender requires 350 W to power the rotating blades that chop food. If the blender has a resistance of 75 Ω , how much current passes through the blender's circuit?
8. A computer with a power input of 230.0 W has a resistance of 91.0 Ω . Find the current in the computer.
9. A laser was developed in 1995 at the University of Rochester, New York, that produced a beam of light that lasted for about a billionth of a second. The power output of this beam was 6.0×10^{13} W. If all of the electrical power was converted into light and 8.0×10^6 A of current was needed to produce this beam, what was the potential difference across the circuit of the laser?
10. Fuel cells are chemical cells that combine hydrogen and oxygen gas to produce electrical energy. In recent years, a fuel cell has been developed that can generate 1.06×10^4 W of power. If this fuel cell has a current of 16.3 A, what is the potential difference across the fuel cell?