Name:_____ Class:_____ Date:_____

Electrical Energy and Current

Problem E

ELECTRIC POWER

PROBLEM

In 1994, a group of students at Lawrence Technological University, in Southfield, Michigan, built a car that combines a conventional diesel engine and an electric direct-current motor. The power delivered by the motor is 32 kW. If the resistance of the car's circuitry is 8.0 Ω, find the current drawn by the motor.

SOLUTION

Given: $P = 32 \text{ kW} = 3.2 \times 10^4 \text{ W}$

$R = 8.0\ \Omega$

Unknown: $I = ?$

Because power and resistance are known, use the second form of the power equation to solve for *I*.

$$P = I^2 R$$

$$I = \sqrt{\frac{P}{R}} = \sqrt{\frac{(3.2 \times 10^4 \text{ W})}{(8.0\ \Omega)}} = 63 \text{ A}$$

ADDITIONAL PRACTICE

1. A flying source of light is being developed that will consist of a metal-halide lamp lifted by a helium-filled balloon. The maximum power rating for the lamp available for the device is 12 kW. If the lamp's resistance is $2.5 \times 10^2\ \Omega$, what is the current in the lamp?
2. The first American hybrid electric bus operated in New York in 1905. The gasoline-fueled generator delivered 33.6 kW to power the bus. If the generator supplied an emf of 4.40×10^2 V, how large was the current?
3. A compact generator has been designed that can jump-start a car, though the generator's mass is only about 10 kg. Find the maximum current that the generator can provide at 12.0 V if its maximum power is 850 W.
4. Fuel cells combine gaseous hydrogen and oxygen to effectively and cleanly produce energy. Recently, German engineers produced a fuel cell that can generate 4.2×10^{10} J of electricity in 1.1×10^3 h. What potential difference would this fuel cell place across a 40.0 Ω resistor?
5. Omega, a laser built at the University of Rochester, New York, generated 6.0×10^{13} W for 1.0 ns in 1995. If this power is provided by 8.0×10^6 V placed across the circuit, what is the circuit's resistance?
6. In 1995, Los Alamos National Lab developed a model electric power plant that used geothermal energy. Find the plant's projected power output if the plant produces a current of 6.40×10^3 A at 4.70×10^3 V.