

Electrical Energy and Current

Problem D**RESISTANCE****PROBLEM**

A clothes dryer is equipped with an electric heater. The heater works by passing air across an electric wire that is heated by the electricity passing through it. If the wire's resistance is 10.0Ω and the current through the wire equals 24 A , what is the potential difference across the heater wire?

SOLUTION

Given: $R = 10.0 \Omega$ $I = 24 \text{ A}$

Unknown: $\Delta V = ?$

Choose the equation(s) or situation: Rearrange the definition for resistance on page 700 to solve for the potential difference across the wire.

$$\Delta V = IR = (24 \text{ A})(10.0 \Omega) = \boxed{240 \text{ V}}$$

ADDITIONAL PRACTICE

1. You have probably heard that high-voltages are more dangerous than low voltages. To understand this, assume that your body has a resistance of $1.0 \times 10^5 \Omega$. What potential difference would have to be across your body to produce a current of 1.0 mA (which would cause a tingling feeling) and 15 mA (a fatal amount of current)?
2. A battery-powered electric lantern is used as a light source for camping. The light bulb in the lantern has a resistance of 6.4Ω . Assume that the rest of the lantern's circuit has no resistance and that the current through the circuit is 0.75 A . Calculate the potential difference across the lantern's battery.
3. Some kitchen sinks are equipped with electric garbage disposals. These are units with rapidly rotating steel blades, which are able to crush and chop up 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 25.0Ω . If the current through the motor equals 4.66 A , what is the potential difference across the motor's terminals?
4. A washing machine motor carries a current through a circuit with a resistance of 12.2Ω . If the washing machine is plugged into a 120 V outlet, what is the current in the motor?

5. If you were to swim in the Atlantic Ocean off the coast of Brazil, the resistance of your body could drop as low as $1.0 \times 10^2 \Omega$. An electric eel in Brazil can have a potential difference of up to 650 V across it. If you came into contact with this eel while swimming, what current would be delivered to your body?
6. When traveling to another country, you should always find out the voltage that is used in that country *before* you plug in an appliance. To understand the reason for this precaution, calculate the current that a laptop computer would draw from a 120 V outlet in the United States if the computer has a resistance of 40.0Ω . Then, calculate the current that the same computer would draw if you plugged it into a 240 V outlet in the United Kingdom.
7. A television set is plugged into a 120 V outlet. The television circuit carries a current equal to 0.75 A. What is the overall resistance of the television set?
8. An electric car is equipped with an electric motor that can deliver 50 horsepower. The voltage across the motor's terminals equals 5.00×10^2 V, and the current through the motor is 0.89 A. What is the resistance in the motor's circuit?
9. A medium-sized household oscillating fan draws 545 mA of current when the potential difference across its motor is 120 V. How large is the fan's resistance?
10. A refrigerator's circuit carries a current equal to 0.65 A when the voltage across the circuit equals 117 V. How large is the resistance of the refrigerator's circuit?