Name _____ Class _____ Date _____

Skills Worksheet

Math Skills

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 Ω, and the current in the wire equals 24 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.

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

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 Ω. If the current through the wire equals 15.6 A, what is the voltage across the terminals of the hair dryer?

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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 Ω. Assume the rest of the lantern's circuit has no resistance and that the current in the circuit is 0.75 A. Calculate the voltage across the terminals of the lantern's battery.

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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 Ω. If the current in the motor is 4.66 A, what is the voltage across the motor's terminals?

4. A washing machine motor works because of a current of 9.80 A in a circuit with a resistance of 12.2 Ω. What is the voltage across the terminals of the motor?

5. A flashlight uses three batteries of equal voltage. The batteries are connected in series, so the overall voltage of the light is equal to the sum of the voltages of each battery. If the resistance of the light bulb's filament is 3.5 Ω and the current in the filament is 1.3 A, what is the total voltage across the filament? What is the voltage across each battery?

PROBLEM

An electric car is equipped with a motor that can deliver 50 hp. The voltage across the motor's terminals equals 5.0×10^2 V, and the resistance in the motor's circuit is 7.5 Ω. How large is the current in the motor?

SOLUTION

Step 1: List the given and unknown values.

Given: *voltage,* $V = 5.0 \times 10^2$ V

resistance, $R = 7.5\ \Omega$

Unknown: *current,* $I = ?$ A

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

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

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

$$I = \frac{5.0 \times 10^2\ \text{V}}{7.5\ \Omega}$$

$$I = 67\ \text{A}$$

PRACTICE

6. A quadraphonic car stereo operates on electricity provided by the car's 12-V battery. Each channel of the stereo, which feeds the electric signal to one of the stereo's four speakers, has a resistance of about 4.1 Ω. What is the current in the circuit of each stereo channel?

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7. When resistors are connected end to end in a circuit, they are said to be in a series. The total resistance equals the sum of all the resistances. Suppose a string of lights has 25 bulbs. Each bulb has a resistance of 8.0 Ω. If the string is plugged into a 120-V outlet, how much current is in the entire set of lights?

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8. A chandelier has 10 sockets, each of which holds a 60.0-W light bulb. Each light bulb has a resistance of 240 Ω. However, the chandelier is wired so that the overall resistance provided by the 10-bulb circuit is only about 24.0 Ω. If the voltage across the chandelier's circuit is 115 V, how much current is in the chandelier?

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9. A window-unit air conditioner has an overall resistance of 22 Ω. If the voltage across the air conditioner equals 115 V, what is the current in the air conditioner's circuit?

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PROBLEM

A television set is plugged into a 120-V outlet. The current in the television is equal to 0.75 A. What is the overall resistance of the television set?

SOLUTION

Step 1: List the given and unknown values.

Given: *voltage,* $V = 120$ V

current, $I = 0.75$ A

Unknown: *resistance,* $R = ?\ \Omega$

Step 2: Write the equation for resistance.

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

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

$$R = \frac{V}{I} = \frac{120\ \text{V}}{0.75\ \text{A}}$$

$$R = 160\ \Omega$$

PRACTICE

10. A medium-sized household oscillating fan draws 0.520 A of current when the potential difference across its motor is 120.0 V. How large is the fan's resistance?

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11. A refrigerator's circuit has a current equal to 0.647 A in it when the voltage across the circuit equals 116 V. What is the resistance of the circuit?

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MIXED PRACTICE

12. A portable, high-intensity lamp contains three bulbs with different power ratings: 150 W, 300 W, and 500 W. The resistance of each of these light bulbs decreases as the bulb's power output increases so that the 150-W bulb has a resistance of 96.0 Ω, the 300-W bulb has a resistance of 48.0 Ω, and the 500-W bulb has a resistance of 29.0 Ω. If the voltage across each bulb is 120.0 V, what is the current in each bulb?

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13. 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 voltages would have to be across your body to produce a current of 5.0 mA (milliamps, or 0.001 A), which would cause a tingling feeling; 10.0 mA, which would be a fatal amount of current; and 1.0 A?

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14. While in 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 resistance of a laptop computer that is designed to draw 3.0 A at 115 V. Then, calculate the current that the same computer would draw if you plugged it into a 220-V outlet, which is common in countries other than the United States.

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