

Ohm's Law $I = V/R$

KEY

1. Fill in the chart for each variable in the equation.

| Name | Definition | Unit |
|------|---|-------------------|
| I | CURRENT FLOW OF ELECT. | AMPS (A) |
| V | VOLTAGE ELECTRO PRESSURE | VOLTS (V) |
| R | RESISTANCE FIGHT AGAINST ELECT. FLOW | OHMS (Ω) |

2. Dry human skin has a resistance of 100,000 ohms.

a. If you touch a 9V battery, what current will flow through you?

$$I = \frac{V}{R} = \frac{9V}{100,000\Omega} = 9.0 \times 10^{-5} \text{ Amps}$$

(NL)

b. What current will flow through your skin if you touch a 120V house outlet?

$$I = \frac{V}{R} = \frac{120V}{100,000\Omega} = 1.2 \times 10^{-3} \text{ Amps}$$

(NL)

3. If your skin is soaked in seawater, your resistance is lowered to 100 ohms.

a. Now how much current will flow through your body if you touch the 9V battery?

$$I = \frac{V}{R} = \frac{9V}{100\Omega} = 0.09A$$

(NL)

b. Now what current will flow through your body if you touch the 120V outlet?

$$I = \frac{V}{R} = \frac{120V}{100\Omega} = 1.2A$$

(FATAL)

PAINFUL...

4. Use this chart to see and your answers to 2 and 3 to see which of the above situations are fatal.

| Current (amps) | Effect on body |
|----------------|------------------------|
| 0.1 and up | Death |
| 0.05 | Painful Shock |
| 0.01 | Mild Sensation |
| 0.001 | Threshold of Sensation |

5. What is the resistance of a vacuum cleaner that is connected to a 120V outlet, and draws 1.2 amps of current?

$$R = \frac{120V}{1.2A} = 100\Omega$$

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

6. A voltage of 5V and a resistance of 200 ohms gives what current?

$$I = \frac{V}{R} = \frac{5V}{200\Omega} = 0.025A$$

7. If the voltage source is 12V, and the current is 3A, what is the resistance of this circuit?

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

$$R = \frac{12V}{3A} = 4\Omega$$

8. What is the resistance of a lightbulb that is connected to a 12.6V car battery that has a current of 0.5 amps?

$$R = \frac{12.6V}{0.5A} = 25.2\Omega$$

9. What is the voltage of a circuit that has a resistance of 65 ohms and a current of 2.5 amps?

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

$$V = 2.5A \times 65\Omega = 162.5V$$

10. If you touch a car battery terminal (12.6V) to your dry skin, how much current will flow into your skin?

$$I = \frac{V}{R} = \frac{12.6V}{100,000\Omega} = 1.3 \times 10^{-4}A$$

11. (Multiple Choice) Which of these things will increase the current flowing through a wire?

- A) increasing voltage
- B) decreasing voltage
- C) increasing resistance
- D) decreasing resistance

12. (Multiple Choice) Which of these things primarily determines if a shock is fatal?

- A) voltage
- B) Current
- C) Resistance

13. When someone asks, "Hey, is 1,000 volts enough to kill a person?" your answer should be, "It depends on the AMPS & LOCATION."