## Resistance and Ohm's Law

## Need to know info:

1. $\qquad$ slows down the flow of electrons and transforms electrical energy.
2. $\qquad$ is measured in ohms. We calculate resistance by applying a voltage and measuring the current.
3. $\qquad$ states that the relationship of voltage (V), current (I), and resistance $(R)$ is given by: $V=I R$.
4. $\qquad$ are electrical components used in circuits to decrease current and convert electrical energy into other forms of energy.

## 5. How do electricians relax?

## Ohm's Law



Ohm's Law By measuring the amount of current that a given voltage produces, Ohm was able to calculate the circuit's resistance. Electrical resistance is the ratio of the voltage to the current. The unit of measurement for electrical resistance is the ohm $(\Omega)$. The mathematical relationship comparing voltage $(V)$, current $(l)$, and resistance $(R)$ is called Ohm's law and is written as:

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

Ohm's law is more commonly written in the form:

$$
V=I R
$$

You can use Ohm's law to calculate resistance.
Read the question: What is the resistance of a flashlight bulb if there is a current of 0.75 A through the bulb when connected to a 3.0 V battery?

Use the formula:

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

State your answer:
6. The resistance of the flashlight bulb is $\qquad$

Try the following Ohm's law problems. Show each step of your solution.
7. The current through a load in a circuit is 1.5 A . If the potential difference across the load is 12 V , what is the resistance of the load?
8.The resistance of a car headlight is $15 \Omega$. If there is a current of 0.80 A through the headlight, what is the voltage across the headlight?

## Converting prefixes

Prefixes are used to work smarter, not harder.
You'll want to know these prefixes ones for the test:
$\checkmark$ milli ( $m$ ) represents one-thousandth
(example: $25 \mathrm{~mA}=\frac{25}{1000} \mathrm{~A}=0.025 \mathrm{~A}$ )
$\checkmark$ kilo (k) represents one thousand

$$
\text { (example: } 5.0 \mathrm{k} \Omega=5000 \Omega \text { ) }
$$

$\checkmark$ mega ( M ) represents one million
(example: $12 \mathrm{MV}=12000000 \mathrm{~V}$ )
When solving a problem where some of the units contain prefixes, first convert the prefixes before you do your calculation.

How to do get questions correct on the test:

- Read the question
- What is the voltage across a $12 \mathrm{k} \Omega$ load that allows a current of 6.0 mA ?
- Use the formula

$$
\begin{aligned}
V & =I R \\
& =(6.0 \mathrm{~mA})(12 \mathrm{k} \Omega) \\
& =(0.0060 \mathrm{~A})(12000 \Omega) \\
& =72 \mathrm{~V}
\end{aligned}
$$

- State your answer
- The voltage across a $12 \mathrm{k} \Omega$ load is 72 V

Try the following Ohm's law problems. Show each step of your solution. Remember to convert prefixes before calculating.
9. A 15 mA current flows through a $400 \Omega$ lamp. What is the voltage across the lamp?
10. A $12 \mathrm{k} \Omega$ load is connected to a 90 V power supply. What is the current through the load in milliamperes (mA)?
11. A device draws a current of 1.2 mA when connected to 120 V. What is the resistance of this device? Give your answer in both ohms and kilo-ohms.
12. Using Ohm's law, state the relationship of current, resistance and voltage

Words to know for the test:

| Conductor | Amperes | Electrical power |
| :--- | :--- | :--- |
| Coulomb | Circuit diagrams | Joule |
| Electric force | Current electricity | Parallel circuit |
| Electrons | Electric circuit | Power |
| Insulators | Electric current | Series circuit |
|  | Electric load | Watt |
|  | Electric potential energy |  |
|  | Electrical resistance |  |
|  | Energy <br> Ohm <br> Ohm's law <br> Potential difference |  |
|  | Resistance <br> Resistor <br> Volt <br> Voltage |  |

## *Remember BC Science 9 hint, wink, nudge... ©)

## Prepare Your Own Summary

You investigated the relationship between current, voltage, and resistance. Create your own summary of the key ideas. You may include graphic organizers or illustrations with your notes. Use the following headings to organize your notes:

1. Electrical Energy
2. Current
3. Voltage
4. Resistance and Ohm's Law
5. Circuits

Copy and complete the following table in your notebook.

|  | Symbol | Unit | Unit Symbol |
| :--- | :---: | :---: | :---: |
| Voltage | V |  |  |
| Current |  | amperes |  |
| Resistance |  |  | $\Omega$ |

Check your understanding. (Circle the ones that you do not know)
13. What is the purpose of a battery?
14. In a battery, what form of energy is converted into electric potential energy?
15. What is the relationship of electric potential energy, charge, and potential difference (voltage)?
16. What unit is used for measuring voltage?
17. What is the purpose of a voltmeter?
18. What is the purpose of an ammeter?
19. Draw the following circuit symbols.
(a) battery
(b) bulb
(c) resistor
(d) voltmeter
(e) ammeter
(f) switch
20. What is the relationship between amperes (A) and milliamperes (mA)?
21. What is the difference between conventional current and electron flow?
22. What are the four basic components of an electric circuit?
23. Explain the relationship between resistance and resistor.
24. State the relationship of voltage (V), current (I), and resistance (R). 16. When an electron passes through a resistor, what happens to its electric energy?
25. What is the purpose of an ohmmeter?

