No clickers & yes calculators.

Have out the 22 study guide w.s. & pg. 594 problems 1 - 5.

Please get the 22.1 notes on the brown table.

May 31-10:13 AM

Resistance and Ohm's Law

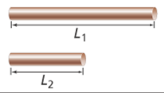
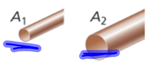
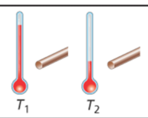
Suppose two conductors have a potential difference (Voltage) between them.

If they are connected with a copper rod, a ___(Larger / Positive)___ current is created.

On the other hand, putting a glass rod between them creates almost ___(NO)___ current.

The property determining how much current will flow is called **resistance**.

The table lists some of the factors that impact resistance.

Changing Resistance		
Factor	**How resistance changes**	**Example**
Length	Resistance increases as length increases.	 $R_{L1} > R_{L2}$
Cross-sectional area	Resistance increases as cross-sectional area decreases.	 $R_{A1} > R_{A2}$
Temperature	Resistance increases as temperature increases.	 $R_{T1} > R_{T2}$
Material	Keeping length, cross-sectional area, and temperature constant, resistance varies with the material used.	R increases: Platinum, Iron, Aluminum, Gold, Copper, Silver

May 31-8:49 AM

Resistance is measured by placing a potential difference across a conductor and dividing the voltage by the current.
The resistance, *R*, is defined as the ratio of electric potential difference, *V*, to the current, *I*.

Resistance $R = \frac{V}{I}$ (voltage / current)

The resistance of the conductor, *R*, is measured in ohms.

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

V = Voltage (potential difference) Unit: volts V

I = current unit: A Amps

R = resistance unit: ohms Ω

May 31-8:53 AM

One ohm (1 Ω) is the resistance permitting an electric charge of 1 A to flow when a potential difference of 1 V is applied across the resistance.

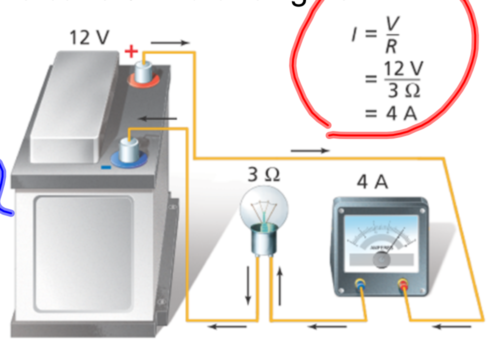
$R = \frac{V}{I}$ $1\Omega = \frac{1V}{1A}$

A simple circuit relating resistance, current, and voltage is shown in the figure.

A 12-V car battery is connected to one of the car's 3-Ω brake lights. The circuit is completed by a connection to an ammeter, which is a device that measures current. The current carrying the energy to the lights will measure 4 A.

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

$V = RI$ $V = 3 \cdot 4 = 12V$



The unit for resistance is named for German scientist Georg Simon Ohm, who found that the ratio of potential difference to current is constant for a given conductor.

R = Potential difference / current

May 31-8:55 AM

The resistance for most conductors does not vary as the magnitude or direction of the potential applied to it changes.

A device having constant resistance independent of the potential difference obeys Ohm's law.

Most metallic conductors obey Ohm's law, at least over a limited range of voltages. Many important devices, such as transistors and diodes in radios and pocket calculators, and light bulbs do not obey Ohm's law.

Wires used to connect electric devices have low resistance. A 1-m length of a typical wire used in physics labs has a resistance of about 0.03 Ω.

Because wires have so little resistance, there is almost no potential drop across them.
To produce greater potential drops, a large resistance concentrated into a small volume is necessary.

A **resistor** is a device designed to have a specific resistance.

Resistors may be made of graphite, semiconductors, or wires that are long and thin

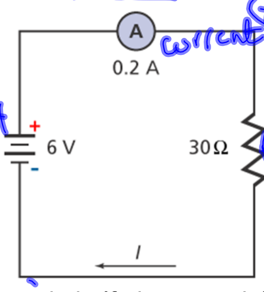
May 31-9:38 AM

There are two ways to control the current in a circuit. Because $I = V/R$, I can be changed by varying V, R, or both.

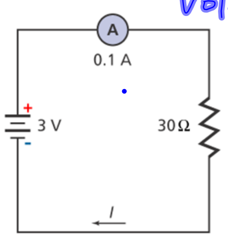
The figure A shows a simple circuit.

When V is 6 V and R is 30 Ω, the current is 0.2 A.

How could the current be reduced to 0.1 A?

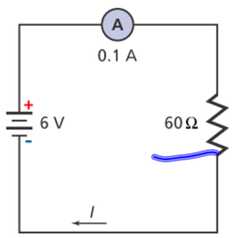


According to Ohm's law, the greater the voltage placed across a resistor, the larger the current passing through it. If the current through a resistor is cut in half, the potential difference also is cut in half.



In the first figure, the voltage applied across the resistor is reduced from 6 V to 3 V to reduce the current to 0.1 A.

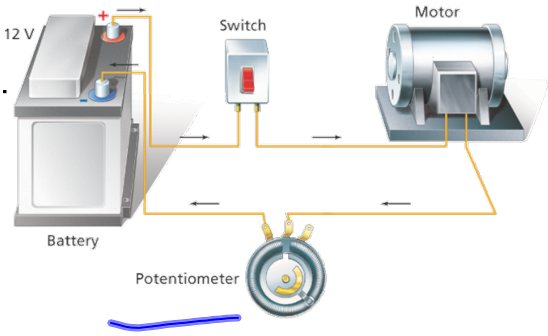
A second way to reduce the current to 0.1 A is to replace the 30-Ω resistor with a 60-Ω resistor, as shown in the second figure.



May 31-9:43 AM

Resistors often are used to control the current in circuits or parts of circuits. Sometimes, a smooth, continuous variation of the current is desired.
For example, the speed control on some electric motors allows continuous, rather than step-by-step, changes in the rotation of the motor.

To achieve this kind of control, a variable resistor, called a potentiometer, is used. A circuit containing a potentiometer is shown in the figure.



Some variable resistors consist of a coil of resistance wire and a sliding contact point. Moving the contact point to various positions along the coil varies the amount of wire in the circuit.

As more wire is placed in the circuit, the resistance of the circuit increases; thus, the current changes in accordance with the equation $I = V/R$.

May 31-9:49 AM

In this way, the speed of a motor can be adjusted from fast, with little wire in the circuit, to slow, with a lot of wire in the circuit.

Other examples of using variable resistors to adjust the levels of electrical energy can be found on the front of a TV: the volume, brightness, contrast, tone, and hue controls are all variable resistors.

The Human Body

The human body acts as a variable resistor.
When dry, skin's resistance is high enough to keep currents that are produced by small and moderate voltages low.
If skin becomes wet, however, its resistance is lower, and the electric current can rise to dangerous levels.
A current as low as 1 mA can be felt as a mild shock, while currents of 15 mA can cause loss of muscle control, and currents of 100 mA can cause death.

May 31-9:52 AM

Ex: 1 A 30.0 V battery is connected to a 10.0 Ω resistor. What is the current in the circuit?

$\frac{V}{R} = I \quad \frac{30.0V}{10.0\Omega} = 3.0A$

Ex: 2 A 9.0 V battery is connected to a 15.0 kΩ resistor. What is the current in the circuit?

$\frac{9}{15} = .6mA \quad \frac{9}{15000} = .0006A$

$6 \cdot 10^{-4}$

Ex: 3 A 60 W lamp is connected to 125 V. What is the current through the lamp?

$I = \frac{P}{V} = \frac{60}{125} = .48A$

$V =$

$125 = .48\,R$

If a resistor is added to the lamp to reduce the current in half, what is the potential difference across the lamp and how much power is now dissipated in the lamp?

$I = .24A$

$R = 260.42\Omega$

$V = I \cdot R$

$= .24 \cdot 260.42\Omega$

$V = 62.5V$

$P = I \cdot V$

$.24 \cdot 62.5$

$= 15W$

May 31-9:54 AM

Vocab Quiz

Thur or fri

① Do Pg. 598 6–11

② 22.1 1–9 & 14–17

May 31-12:48 PM