Do Now

- Write an example of how an object can gain a charge from induction and friction.
- Induction:
- Friction:

Today

- Finish Statics
- Sticky Tape Lab
- ~~Electroscope Activity~~
- Begin ~~Coulomb~~'s Law

Ohm's

Stick Tape

- You will need one set of directions per lab table.
- You will each need your own data sheet and follow up questions.

Demo: Part 1

- Two lines of tape.
- Each line has two layers.
- Each piece has a handle.

Demo: Part 2

- 2 columns of tape.
- 3 pieces: Top (T), Bottom (B) and Base
- Figure in 11: F is foil and P is paper.
- Look for specific demonstration.

Summary Page

- Sketch and label your observations for procedure numbers 5, 8, 9, and 13 as directed.
- Make sure to label the forces that are acting on each material.
- Remember Newton's 3rd: action and reaction. Forces in pairs.

Thoughts Page

- Answer all questions in full sentences.
- Label all diagrams.
- Finish for homework if we move on before you finish.

Good Morning!

Please take out a notebook, calculator and something to write with.

Take a look at the TV in the front of the room. What will happen when I turn it on?

What kind of charging can you observe?

Where do you see this?

Electric Potential

- The more charges are separated, the more electrical energy will be **discharged** when the system returns to equilibrium.

Ohm's Law Ω

- V=IR
- V is voltage
  Volts
- I is current
  Amps
- R is resistance
  ohms

Units of V=IR

- Voltage (V): volts V
- Current (I): amps A
- Resistance (R): ohms Ω

Metaphor: Pressure in a pipe.

Voltage could be considered the flow rate of water in the pipe.

Resistance is the radius of the pipe.

Current would be the pressure inside the pipe.

Focus on the Positive

- When we talk about circuits, we imagine that the charge is moving from the positive to the negative terminals of a battery.
- The positive end of a battery has a high potential energy.
- The negative end, a low one.

Volts

- Change in electrical potential.
- A charge gives off energy when if goes through a resister (ex: lightbulb).
- The difference in electrical potential energy is referred to as a voltage drop.

Volts and Work

- As the voltage drops, energy transferred.
- The electrical potential energy is transformed.
- Work is performed on the system.

V=IR

- Problem solving:
  - Knowns:
  - Unknown:
  - Equation: V=IR

A 9 volt battery is attached to a circuit with a light bulb with a 30 Ω bulb. Find the current in the circuit.

K: $V = 9v$ $R = 30\Omega$

U: $I = ?$

$$\frac{V = IR}{R \quad R} \Rightarrow I = \frac{V}{R} = \frac{9V}{30\Omega} =$$

$0.3\ A$

A curling iron has a resistance of 18 Ω. If the wall socket provides 120 volts, what is the current in the wire?

K: $R = 18\,\Omega$, $V = 120\,V$

U: $I = ?$

$$V = IR \quad \frac{V}{R} = I = 6.67\,A$$

Electrical Power [watts]

$VI = P$

- $P = V\,I$
- $P = R\,I^2$
- $P = V^2 / R$

A microwave requires 1200 watts of power. If the plug supplies 120 volts, what is the current in the wire?

K: $P = 1200\,W$, $V = 120\,V$

U: $I = ?$

$$\frac{P = IV}{V} = \frac{1200\,W}{120\,V} = 10\,A$$

A microwave requires 1200 watts of power. If the plug supplies 120 volts, what is the resistance of the appliance?

K: $P = 1200\,W$, $V = 120\,V$

$I = 10\,A$

$P = I^2 R$ $\qquad$ $P = \frac{V^2}{R}$

$V = IR$

An iron has a power rating of 1000 watts. What is the voltage from the power supply if the resistance is 140 Ω?

Ki: $P = 1000\,w$, $R = 140\,\Omega$

U: $V = ?$

$P = V^2/R \Rightarrow V = \sqrt{RP} = 373\,V$

Homework

- You will have to convert kWhour into joules.
- Use dimensional analysis.
- Ask questions about problems that you have.
- Finish it overnight.

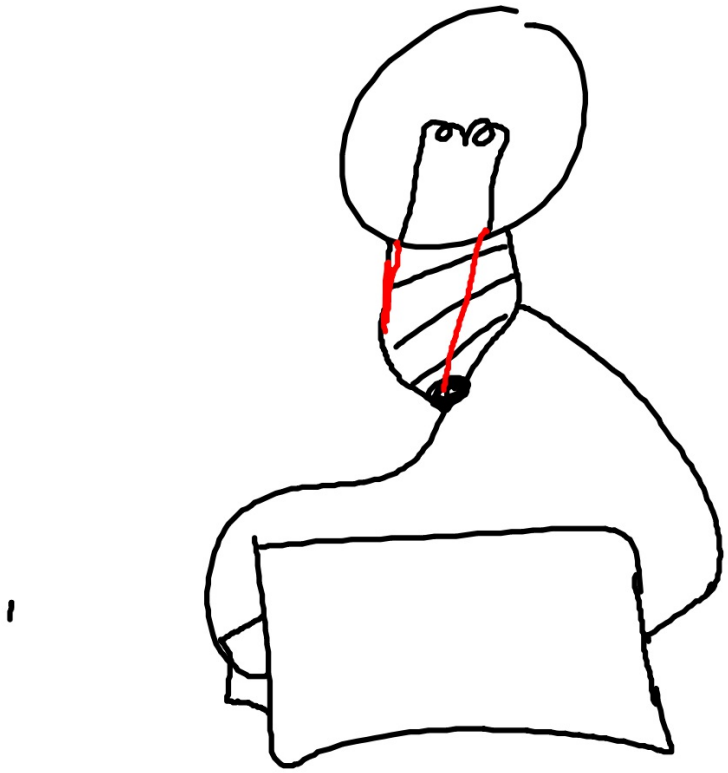
Circuits:
Get a handout with the 10 basic pictures if batteries, light bulbs and wires on it.
Guess which set ups will light the bulb.

Get a battery, wire and bulb from the front. (groups of 2)

Go through and create each circuit that you see.

Write down the result and compare it to your guess.

What's needed to light the bulb?



Modern Light Bulb Video

How fast does electricity travel through a wire?

Work, Energy and Power Quiz:

Grades are on IC. Check that the grade on your quiz is the same as the one online.

Plasma Globe:

Electric Potential energy is stored at the top of the column.

It has to go somewhere.

Wants to leave the like charges in the center.

Path of least resistance.

Tesla Coil:

There are 2 coils.
One coil induces a current in another coil.

Charge builds at the top.

Charge has to go somewhere.

Grab a laptop.

Go to physicsclassroom.com

Under Current Electricity: Lesson 2

Misconceptions about electrical circuits.

Take the quiz at the beginning.

Read over the explanations at the bottom.

Do Now:

Take out a calculator, pencil and a notebook.

Can you explain what is going on inside the plasma globe?

Plasma Globe:

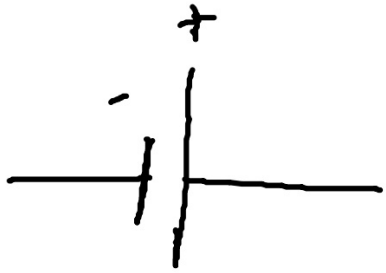
Electric Potential energy is stored at the top of the column.

It has to go somewhere.

Wants to leave the like charges in the center.

Path of least resistance.

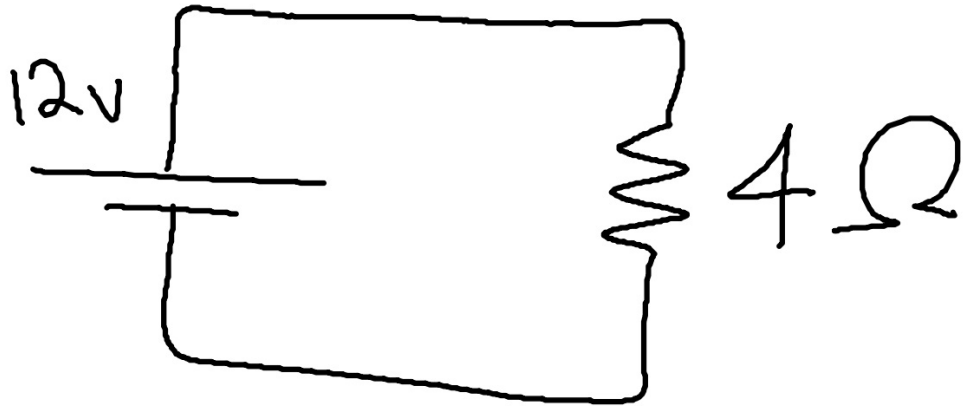
Circuit Depiction:
You will need to draw representations of circuits.

Battery: 

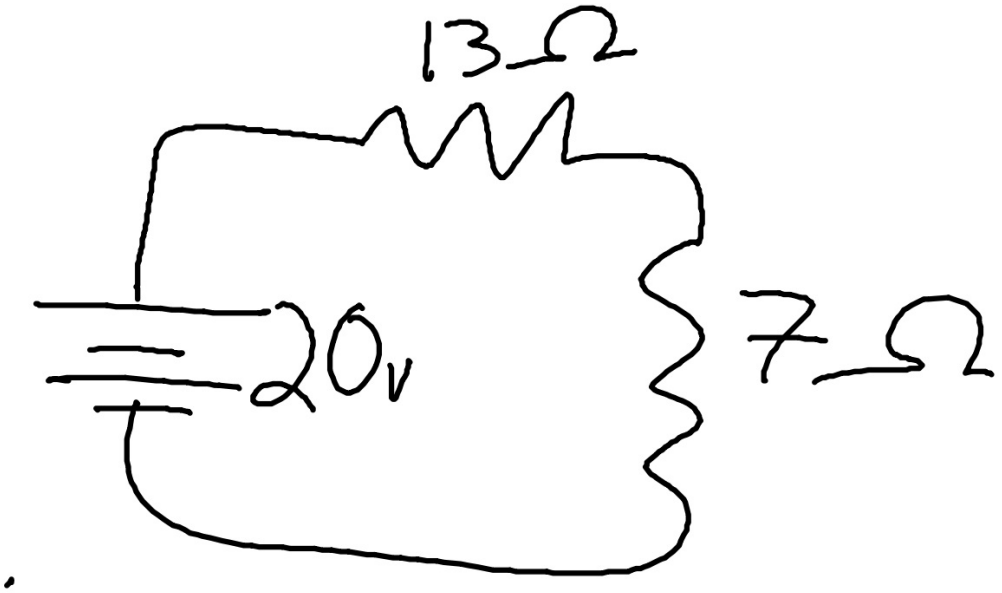
Resister: 

Wire: 

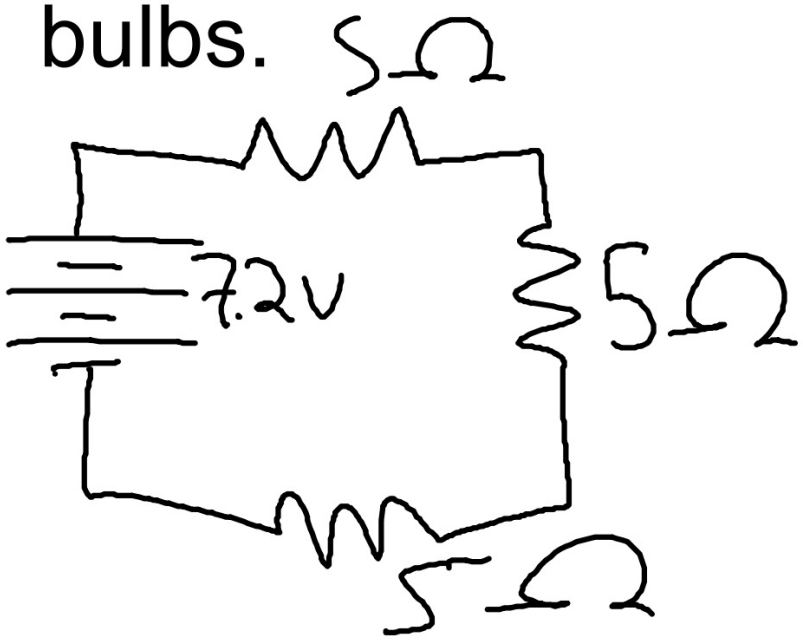
Draw the following:
A 12v battery is connected to a 4 ohm resister.



Two 10v batteries are connected to a 13 ohm resister and a 7 ohm resister in series.



Three 2.4V D-cells are placed in a battery pack to power a circuit containing three 5 ohm light bulbs.



Circuits with resisters in series:

Multiple resisters on a wire.

Resistance adds:

The total resistance of the circuit is equal to the total resistance of each resisters.

R(total)=R1+R2+R3+etc.

A 12v battery is connected to a circuit with resisters in series. There are 3 resisters, measuring 12, 14 and 18 ohms. What is the total resistance in the circuit?

$R_{tot} = R_1 + R_2 + R_3 = 44\Omega$

Current remains the same throughout a circuit.

Find the total resistance of the circuit.

Use the voltage to find the current.

There will be a different voltage on each resister.

The voltage on all resisters should total voltage of the battery.

Power at each resister and the total power.

You can find the total power consumed at each resister using P=IV.

There is also a total power for the entire circuit. This is based on the total Voltage, Current and resistance of the circuit.

The total power for the circuit may be different than the sum of the componenet resisters.

Resisters in **Series:**

$R_{tot}=R_1+R_2+R_3+etc.$

$I_{tot}=I_1=I_2=I_3=etc.$

$V_{tot}=V_1+V_2+V_3+etc.$

Method for solving problems:

Draw the circuit.

Find the total resistance of the circuit.

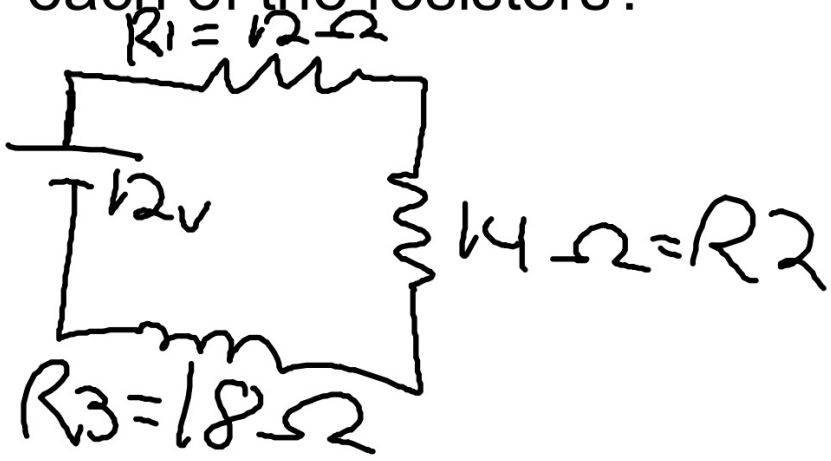
Use the total voltage to find the current throughout the circuit.

There will be a different voltage on each resister.

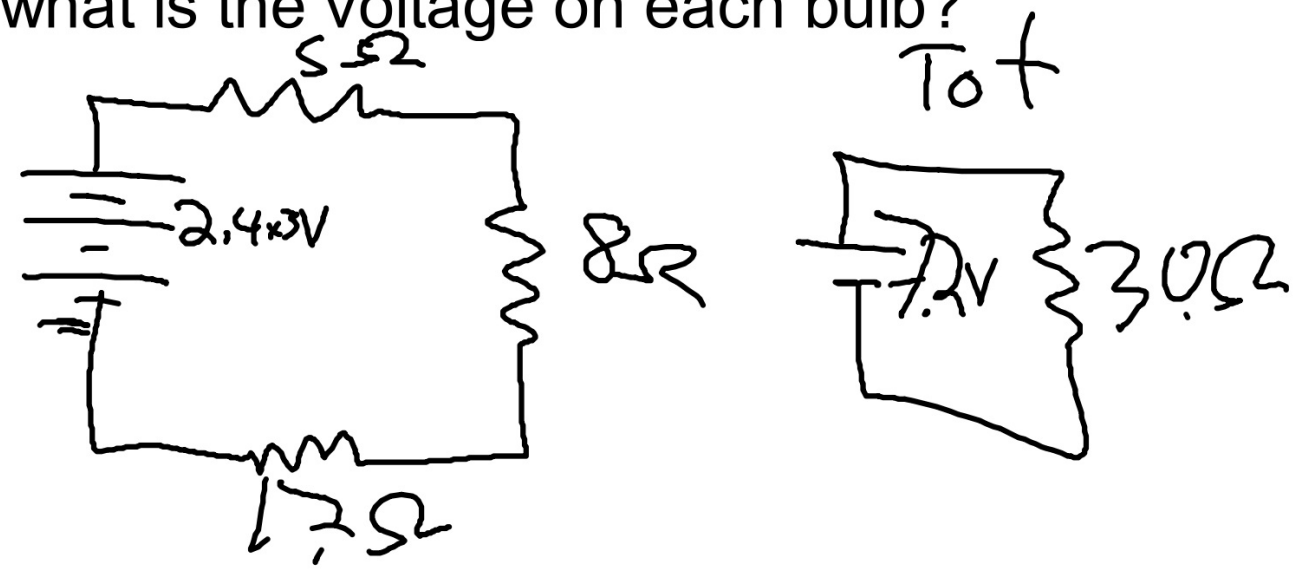
Make a table.

Resister # V on # I on # Ω of #

A 12v battery is connected to a circuit with resisters in series. There are 3 resisters, measuring 12, 14 and 18 ohms. What is the current in the circuit? What is the voltage on each of the resisters?



Three 2.4v D-cells are placed in a battery pack to power a circuit containing three light bulbs. Batteries in series add voltage (V(tot)=7.2v). If the bulbs are 5, 8 and 17 ohms respectively, what is the voltage on each bulb?



A 90v generator powers a refrigerator with a resistance of 120ohms and a dehumidifier with a resistance of 230ohms in series. Find the voltage and power (consumption) for each appliance.

Quest:

You have the remainder of the class to work on the quest assignmnet.

You should be able to complete the first 9 questions with what you have learned so far.

Work, power and energy quiz.

Please look over the quiz.

I will put the grades onto IC this afternoon.

Do Now:

Draw the circuit and complete a table with V, I, R and P for all resisters in the circuit.

A 120V outlet supplies electricity to 3 resisters in series. The resisters are 30, 40 and 50 ohms respectively. What is the voltage and power consumption of each resister?

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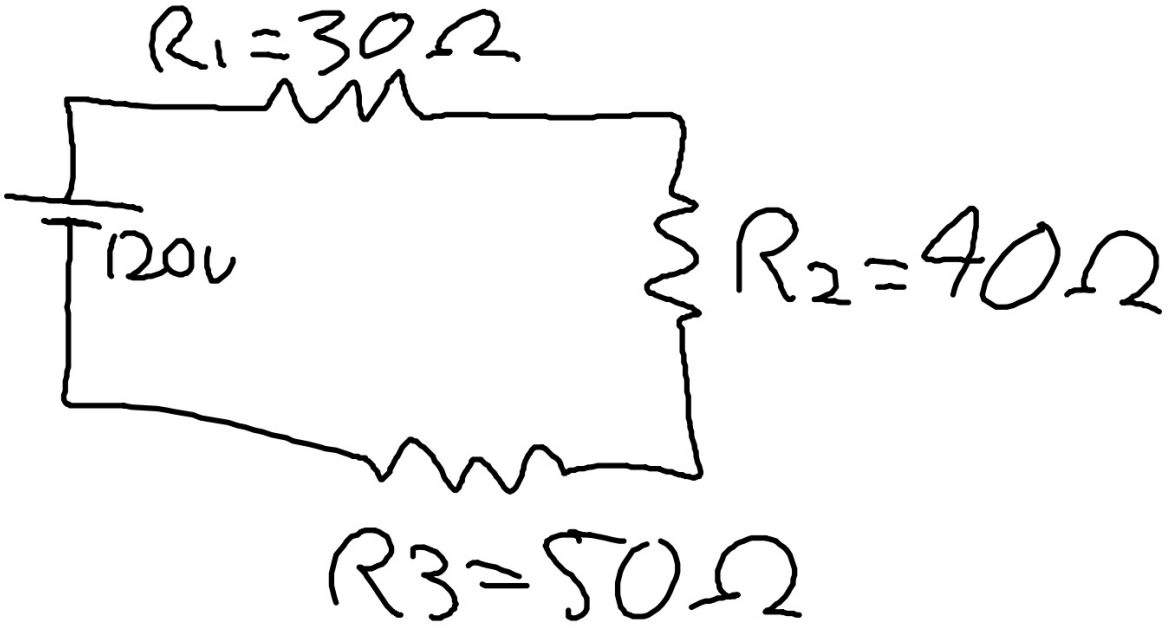


Circuits in Parallel:

Electricity reaches the resisters at the same time.

The voltage remains constant across all resisters.

V(tot)=V1=V2=V3=etc.

Resistance on resisters in parallel:

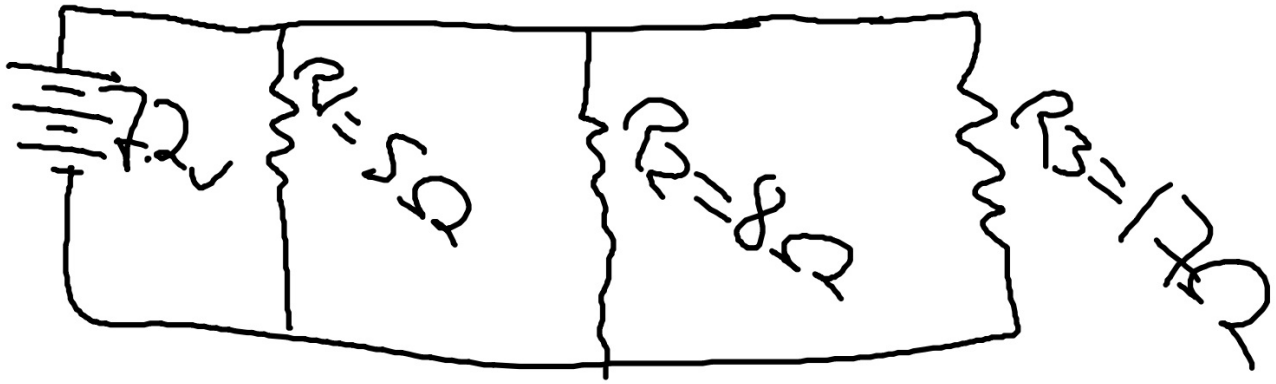
The reciprocal of the total resistance is equal to the reciprocal of each resister.

$$1/R(tot)=1/R1+1/R2+1/R3+etc.$$

A 10v battery is connected in parallel to a 13 ohm resister and a 7 ohm resister. What is the total resistance of the circuit?

A 12v battery is connected to a circuit with resisters in parallel. There are 3 resisters, measuring 12, 14 and 18 ohms. What is the total resistance of the circuit? What is the current on each of the resisters?

Three 2.4v D-cells are placed in a battery pack to power a circuit containing three light bulbs in parallel. Batteries in series add voltage (V(tot)=7.2v). If the bulbs are 5, 8 and 17 ohms respectively, what is the current on each bulb? What's the power consumed?



A length of wire is cut into 8 equal pieces. It is then arranged into a parallel circuit with a resulting resistance of 5 ohms. What was the original resistance of the wire before it was cut?

Maximize Power:

Find the arrangement that creates the brightest bulbs.

This would be the largest power consumption.

Investigate the power of bulbs in both series and parallel.

A 9v battery is connected to a 5, 9, and 14 ohm light bulb. What arrangement (series or parallel) would be the greates power output? This would create the brightest lights. Bulbs burn brighter with a higher voltage.

Phet simulation:

Get a handout.
Search Phet.
Physics Simulations.
Circuit Construction Kit (DC only)

Create the circuits and fill out the table at the bottom of the page.
Use the back of the handout to draw schematics.

Combined circuits:

Resolve the resistance of each **branch** of the circuit.
Represent it as a single resister.
Continue until you find the total resistance of the circuit.
Work backwards to solve for the voltage and current on each resister.

A 9V battery is connected to a 9, 14 and 5 ohm resister as shown. Find the total resistance on the circuit. We will find the voltage on each resister in a moment.

A 12v battery is connected to a circuit with resisters as shown. There are 3 resisters, measuring 12, 14 and 18 ohms. Find the total resistance of the circuit. We will find the voltage on each resister in a moment.