

Power to All the People



Introduction to Alternative Energy and Electricity

Preparation

- Go to the notes/illustrations on wiki Introduction to Alternative Energy
- Photocopy "Power to all the People" notes template for each person
- Test Projector and have wiki up on the screen to "Intro to Alt Energy"

For each pair of people:

Paper Plate

Multimeter

Squishy Conductive Dough

Pencil

Battery Pack

Solar Panel

Calculator

2 LEDs

2 Lights (testing solar cells)

2 Note Templates

1 buzzer

Pair of alligator clip connectors

Learn 2 Teach, Teach 2 Learn Wiki Page:

<http://learn2teach.pbworks.com/w/page/40939766/Power-to-all-the-People>

MAIN CONCEPTS

Alternative Energy: Energy produced without fossil fuels

Renewable Energy: Sources of energy that are constantly replenished and will never run out: Wind, Solar, Hydroelectric, Bioenergy, Hydrogen (Fuel Cells), Geothermal

Nonrenewable Energy: Sources of energy that are limited and will eventually run out or become too expensive or damaging to retrieve: Coal, Oil, Natural Gas

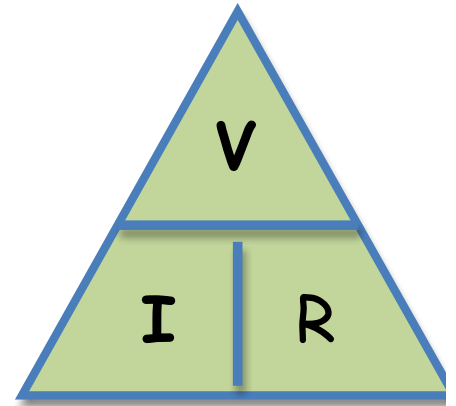
Electricity: When electrons move among atoms of matter, a current of electricity is created.

Ohm's Law: Relationship between electrical properties
Voltage = Current x Resistance $V = IR$

Voltage is difference in electric potential (volts)

Current is the rate of flow of electrons (amps)

Resistance is opposition to flow of electricity



Multimeter: A device that can measure a lot of stuff, including voltage, resistance & current. (it's like a swiss army knife for geeks!)

Specifications: a detailed description of how to use something
In designing your stuff, look for the voltage & current requirements

Goals

1. Introduce Alternative Energy
2. Introduce ideas about electricity
(you will need these to power your projects)
3. Build a simple electrical "squishy circuit"
 - a. measure current and voltage using a multimeter
 - b. look at the specifications for the LED
4. Explore using both batteries and solar panels as energy sources

2-3 Core Ideas

What is alternative energy, unrenewable energy, and renewable energy?

What is Ohm's law, how is it expressed as an equation and a triangle?

What is a multimeter and how do you use it?

What are specifications and why are they important?

Teaching the activity

Introduce Taking Notes (5 minutes)

- Make sure people have the notebook & pencil
- Explain that they will be using it to record the activity
- Have them put their names at the top

Introduction to Alternative Energy (15-20 minutes)

- Explain that they will be learning about renewable/nonrenewable energy and recording it in their notebooks
- Use notes, pictures & questions from wiki to lead discussion
- Check to make sure everyone has filled out the front page of the notebook

Introduction to Electricity (45 minutes)

- Break people into pairs and have them sit around the table
- Explain that many of their projects will require them to use some source of energy as power; This activity will help them learn the basic concepts and tools they will need
- Explain they will be learning Ohm's Law, build a simple "squishy" circuit and using the multimeter and specifications in the process.

Ohm's Law

- Ohm's Law is a simple relationship that you need to know to understand and use electricity
- Show the 6 minute Make Magazine Ohm's Law video (posted on the wiki)
- Record Ohm's Law in equation and pyramid form in notebook

Measuring Voltage using the Multimeter

- Have everyone take out a multimeter and each pair take out their battery pack
- Go over different batteries
Square = 9V, AA = 1.5 V
4 AA in series = $1.5+1.5+1.5+1.5 = 6V$
- Explain the Multimeter

How to turn on and off --- important to ALWAYS turn off
Parts: Dial, Positive Lead, Negative Lead
Measuring volts --- set the dial to 20 volts
Take out power source and measure voltage across leads
Record voltage of power source in notebook (trade)

Building the Squeaky circuit

- Have each pair get paper plate, conductive dough, LED, buzzer
- Explain the circuit they are going to build using diagram
- Explain conductive dough, resistance in dough & make two logs
- Explain that the two logs CANNOT touch; short circuit!
- Remind them that RED = positive; BLACK = negative
- Have them connect the power supply
- Take out buzzer and connect it! NOISE!
- Explain the LED has LONG positive lead, SHORT negative lead
- Connect the LED and see it light up. LIGHTS!

Using multimeter to measure current and calculate resistance

- Explain current, that they will use the multimeter to measure the current and then use Ohm's law to calculate resistance.
- Explain current measured in ma = milliamps = 1/1000 amp
- Explain how to set multimeter to measure current @ 20ma
- Explain that each person will do the measurement
- Explain how to:
 - put positive red lead of MM on positive end of LED
 - put negative black lead of MM on ground of battery
 - OK if the light goes out
 - OK if current goes all over, just adjust until reading settles
(conductive dough imperfect & doesn't conduct evenly!)
 - What does the current reading say?
 - Explain how to convert ma to decimal (e.g. 20ma = .02 a)
 - Record current in notebooks
 - Use Ohm's Law to calculate resistance of the conductive dough
 - Record resistance in notebooks
 - SWITCH PARTNERS SO EACH HAS EXPERIENCE

Changing the resistance of the conductive dough

Explain how you can change the resistance of conductive dough

by changing size of conductive dough and how we are going to look at two different resistance of the dough

One person reads the current, One person records & calculates

Have people make the conductive dough **short and fat**

Measure the current with MM:

Keep the MM on the current setting of 20ma

Red lead on + LED lead, Black lead on ground of battery

Play with it and wait until reading settles a bit

Record the current reading in notebook

Calculate the resistance of short fat conductive dough

SWITCH PARTNERS

Have the people stretch out the squishy dough long and skinny

Keep the MM on the current setting of 20ma

Red lead on + LED lead, Black lead on ground of battery

Play with it and wait until reading settles a bit

Record the current reading in notebook

Calculate the resistance of long skinny conductive dough

What happens to resistance as you change the size of squishy dough? (shorter decreases resistance, longer increases resistance)

Record finding in notebook

Looking at specifications

What is a specification?

When do you use specifications?

Go to Evil Mad Science site

Look at the specifications for LED on Evil Mad Science

What's listed in the specification?

What color is your LED? Record it.

What's are the voltage and current specs for it? Record it.

Using a Solar Panel instead of a battery

Is a battery a renewable or nonrenewable energy resource?

(Nonrenewable)

We can replace the battery with a solar panel

How does a solar panel work? (see wiki)

Replace battery pack with 3V solar cell

Connect alligator clip connectors to solar cell

Take circuits outside/under lamp and test

What happens? (LED not as bright)

Why is LED not as bright?

Voltage OK, must be current is low

What could we do to increase the current

Connect two solar panels in series

(like AA Battery pack)

Clean-Up!

Wrap up leads on multimeters and put back in tray

Put battery packs back in trays

Put LEDs and buzzers back in trays

Put alligator clips and solar panels back in trays

Extra Time

Show video by Van Jones and talk about Green Economy

Why is alternative energy important to Communities of Color and low income communities especially?

- Environmental justice
- Green economy