



RPI students supporting education outreach

***Electromagnetic Spectrum
Introduction and Bulb
Comparison; LED, Compact
Fluorescent, Incandescent Bulb
Comparison***

Target Audience: Elementary school students (grades 3-6)

Objectives:

1. Introduce power of light; application of visible and invisible uses.
2. Introduce variety of visible light sources and show differences within the electromagnetic spectrum.
3. Introduce attributes of LED light and discuss efficiency of light verses conventional light sources.
4. Introduce hands on activity of building a LED throwies whereby students have an opportunity to observe the power of a LED light bulb closely and make a neat toy.

BOM: Diffraction Slides (1 per student), presentation set up; computer/screen/projector, USB Microscope, LED simple circuit; LED, protoboard, wires, 9 Volt battery, resistor, potentiometer, Materials for LED Throwies; LED (any color), 3V Lithium battery, ½” diameter x 1/8” thick NdFeB Disc Magnet, NiCu-Ni plated, scotch tape. Three simple reflector clamp-on lamps each holding a different 40 equivalent watt (40 Lumen equivalent) for lamps.

Item	Source / website	Price
Diffraction Slides	www.rainbowsymphonystore.com/difgratslidl.html	\$.35 / each
Spectrometers	www.scientificsonline.com - selection	Varied pricing
Reflective Clamp Lamp – Coleman Cable Clamp Light	www.sears.com/shc/s/p_10153_12605_SPM2157487603P?prdNo=16&blockNo=41&blockType=G41	Approx. \$9.37
LED Bulb 40 Lumen equivalent (Sylvania)	Lowe’s or Home Depot	Approx. \$22.00 each
Compact Fluorescent Bulb 40 Lumen equivalent (GE)	Lowe’s or Home Depot	Approx. \$6.50 each
Incandescent Bulb 40 Lumen equivalent (Sylvania)	Lowe’s or Home Depot	Approx. \$.50 each
Lamp Stand	Make shift structure that could support the three reflective lamps.	No cost available.
Bread board	Electronix Express part # 03MB101 3.3” x 1.8”	Approx. \$2.70
Wires	Electronix Express Jumper Wire for breadboards Part No. 2700RJW90	Approx. \$16.95 / bundle

Resistor Kit (incl. 470K)	Electronix Express Part No. 13RK2501	Approx. \$ 6.75 each set
9Volt Battery Snap	Electronix Express Part No. 2801BSI	Approx. \$.25 each small qualities
Potentiometer	Electronix Express part # 18STS value	Approx. \$.90 each
9 Volt battery	Allied Electronics Item # 774-0240 Dantona Industries, Inc.- Part # LLG-9V G6F22 battery; Carbon Zinc 9V	Approx. \$.43 each
LEDs	Electronix Express Super Bright LED 5 mm Red, Green, Yellow, Blue, Amber Part # 08LCH – color designation	Range - \$.20 - \$1.10 each
USB 1.3 Megapixel Digital Microscope	http://www.thinkgeek.com/gadgets/electronic/9955/	\$349.00 each
3V Lithium Batteries (throwies)	Cheap Batteries http://www.cheapbatteries.com/coin.htm Panasonic CR 2032 Product # CR2032	\$.25 each
Small Magnest	Amazing Magnets http://www.amazingmagnets.com/show-fractional-d125d.aspx 1/2" Dia x 1/8" Thick NdFeB Disc Magnet, Ni-Cu-Ni plated	Approx. \$.40 each
Scotch tape	Standard product	Misc.

Set Up: Position stand with three clamp lamps between 4 – 10 feet from students. Position three clamp lamps with different bulbs as shown in picture below positioned vertically with incandescent (top position), compact fluorescent (middle position), LED Bulb (lower position). Computer set up for presentation and the USB Microscope with LED Simple circuit positioned in scope. Hand out diffraction slides after describing electromagnetic spectrum. LED throwies materials to be handed out as final hands-on activity.

Activities:

1. Beginning with the presentation, introduce importance of lighting. Introduce the Electromagnetic Spectrum and the wide range of wavelengths and photon energies including those of visible light and invisible light – undetectable by the human eye – such as infra-red, x-ray, ultraviolet.
2. Discussion of various well known applications of visible and invisible light and how it relates to the Electromagnetic Spectrum.
3. Observe the colors of visible light; violet to red using small handheld, spectroscope and diffraction slide.
4. Observe difference of color spectrum with different light sources; compact fluorescent, LED, incandescent light.
5. Using the computer, USB microscope projection equipment show the students the structure of the LED.
6. Make a LED throwie. <http://www.instructables.com/id/LED-Throwies/>
7. Provide interaction with engineering students.
8. Take general questions on the experience of being an engineering student

Outcomes:

1. Audience will be better informed about the power of light, different lighting technologies, and gain an understanding of the electromagnetic spectrum.
2. Audience will have an opportunity to interact with graduate and undergraduate engineering students.

Resources:

The major resources required for mentors or for self-guided exploration are included in the handouts.

Takeaways:

Engineers are involved with cool things that make our world a better place.

