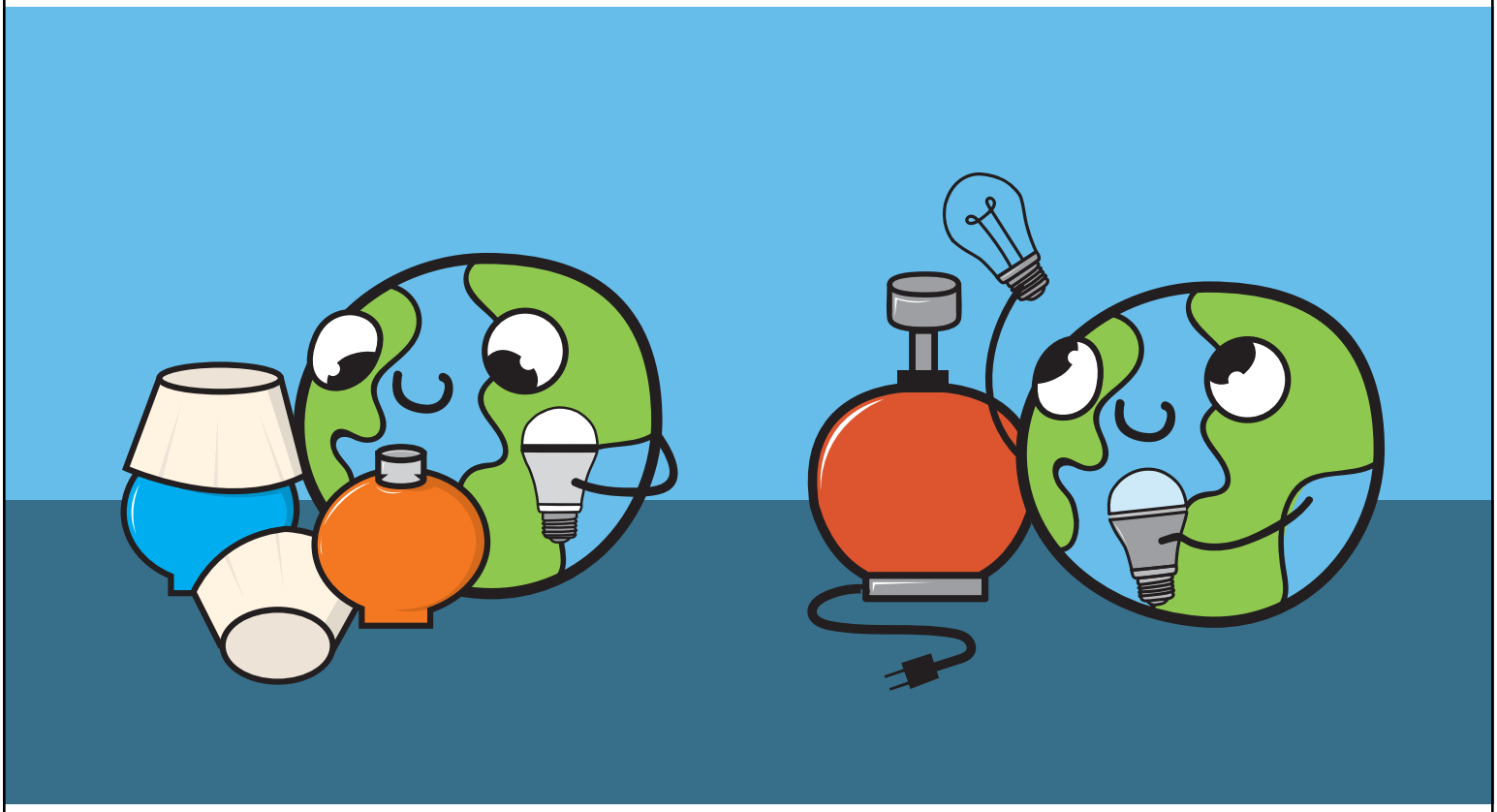
Home Energy Challenge

Energy Awareness Month Edition

Light Bulb Comparison Activity

Families can celebrate Energy Awareness Month by completing this fun circuits and lighting activity that will showcase the difference in energy use between incandescent and LED bulbs.



NEED National Energy Education Development Project

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Light Bulb Comparison Instructions

What's In The Kit

- Digital multimeter with red and black leads
- 4 Alligator clip wires
- 2 Battery holders
- 2 AA batteries
- 1 Mini-incandescent bulb
- 1 Mini-LED bulb
- 1 Light bulb holder

✪Home Energy Challenge Light Bulb Comparison Activity Background

Using efficient lighting uses less energy, which saves money, but it also has a positive effect on the environment because efficient lighting reduces carbon dioxide emissions and landfill waste in burned-out light bulbs. When shopping for a light bulb, we should consider two important pieces of information, both of which are found on the Lighting Facts label of the bulbs. The first is how bright the bulb is, or the number of lumens produced. The higher the number of lumens, the brighter the bulb will be. The other important factor to consider is how many watts of power the bulb uses to produce light. This will tell you how expensive the bulb will be to operate. This activity will help you and your family to see the wattage differences in two types of lighting: incandescent and LED bulbs.

LIGHT UP YOUR LIFE

In 1879, Thomas Edison perfected the incandescent light. For the next 100+ years, lighting did not change much. The materials and bulb life improved, but the functionality of light bulbs in American households went largely unchanged for more than a century. Incandescent bulbs work by using electricity to heat up the thin metal wire inside the glass bulb. This wire, called a filament, glows, creating light when electricity heats it up. Incandescent light bulbs are exceptionally inefficient light makers, using only 10 percent of the electricity input to produce light! The other 90 percent of energy used by an incandescent is wasted as heat energy.

Light emitting diodes, better known as LEDs, are a newer, more common lighting option. Once used mainly for exit signs and power on/off indicators, improved technology and lower prices enable LEDs to be used in place of incandescent bulbs. LEDs are one of the most energy-efficient lighting choices available today, using 75% less energy than traditional incandescents, lasting thousands of hours longer, too. LEDs create light by passing electricity through a special material called a semiconductor. This semiconductor is called a diode, and when the electric current flows through it, it casts, or produces. light.

CIRCUITS: KEEPING YOU IN THE LOOP

In order to take a closer look at how these two bulbs use power differently, we will need to hook them up. The bulbs we're working with are too small to plug into a lamp, so we'll be using a special light bulb holder and batteries to provide power. We'll need to use wires, called alligator clips, to connect the bulb to their power source. Lighting fixtures and lamps are hooked up in the same way in your home, but are instead powered by electricity from your electric utility, like Eversource.

GENERIC LIGHTING FACTS LABEL

Lighting Facts Per Bulb

Brightness	**XXX lumens**
Estimated Yearly Energy Cost	**$X.XX**
Based on 3 hrs/day, 11¢/kWh	
Cost depends on rates and use	
Life	
Based on 3 hrs/day	**X.X years**
Light Appearance	
Warm — Cool	
XXXX K	
Energy Used	**XX watts**

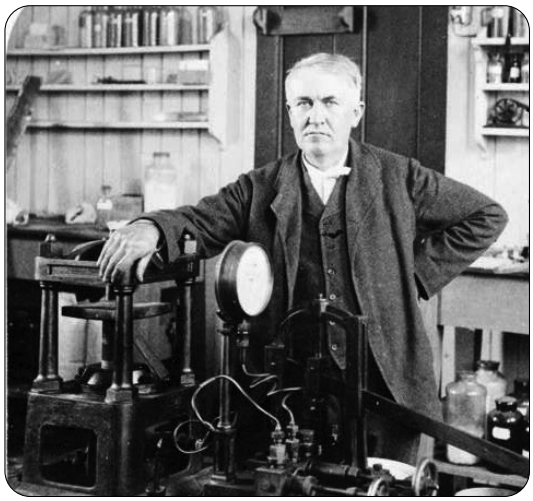


Image courtesy of U.S. Library of Congress
Thomas Edison in his lab in 1901.

Electricity travels in closed loops, or circuits. A circuit usually has a few parts – the energy or power source, wires, an electrical device, and a switch. Electricity must have a complete path between all of these items before the electrons can move – the wires make this happen. If any part of a circuit is open or disconnected, the electrons cannot flow. When we flip on a light switch, we close a circuit. The electricity flows from the electric wire through the light and back into the wire. When we flip the switch off, we open the circuit. No electricity flows to the light. You will open and close your "switch" by connecting and disconnecting the light bulb.

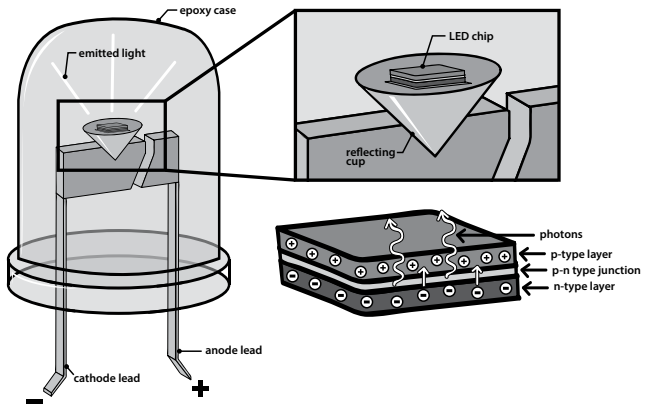
WATT'S THAT YOU SAY?

Once we hook up the bulbs to a power source (the batteries), we can use a meter called a multimeter to measure how each is using energy. We use units called watts to measure the electricity that we use. A watt is a measure of the electric power an appliance uses. Every appliance requires a certain number of watts to work correctly, and each of the bulbs in this kit use a different number of watts. What if the meter you use does not measure watts? Well, electric power is the combination of the of the amount of electric current flowing and the pressure pushing it through the circuit.

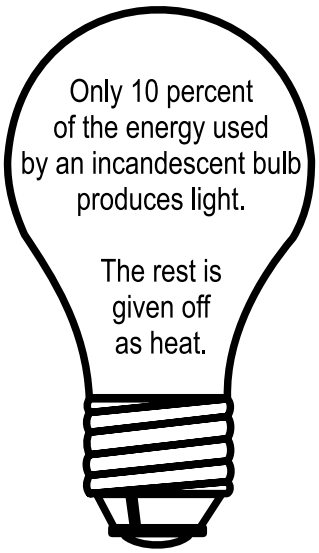
The electric current is the number of electrons flowing between two points in a circuit. It is very much like volume – how much electricity is flowing at one time. Current is measured in amperes, or amps (A). Each of the bulbs in this kit uses a different number of amps – one uses a larger volume of electricity than the other. The pressure that pushes electrons in a circuit is called voltage. We measure the voltage in volts (V) which tells us how strong the current is in a circuit. Both of the bulbs in this kit can handle about 3 volts of pressure. The batteries each provide 1.5 volts, which helps supply enough power. When we multiply the current (A) by the voltage (V), we can determine exactly how much power each bulb is using!

We can apply our findings to our homes. Small LED and incandescent bulbs are just like the ones we use in our lamps and fixtures, they are just different sizes and shapes. If you find that one type of bulb uses less energy than the other, a larger version of the same bulb will also use less. The more energy you save, the more money you save. The more energy you save, the more resources you save!

Inside an LED



INCANDESCENT BULB (LEFT) / LED BULB (RIGHT)



Home Energy Challenge

Light Bulb Comparison Instructions

Homes and businesses use several types of lighting. Incandescent bulbs are the bulbs that were once used by almost everyone. Today, homes and businesses are switching to LED lighting fixtures and bulbs. Let's look at why this might be happening! In this activity we will use electricity from batteries, and wire our lighting in a completed circuit, just like they might be wired behind the walls of your house. We'll use a meter and some quick math to figure out why some bulbs, like LEDs, save us money and energy!

⚠ Safety Notes

- Only use the batteries provided with this activity. If your batteries die, replace with only AA batteries.
- Assemble the circuit following the instructions. Do not connect wires and batteries to other devices or materials.
- Make sure your workspace is clean and dry.

✔ Procedure

PART 1: LET'S MAKE A SERIES CIRCUIT!

In order to compare the light bulbs, you need to assemble a circuit. This circuit will include a power source for the bulbs, and the wiring to connect the bulb to the power source. The batteries are the power source. You will also add a multimeter into the circuit, so you can take measurements and compare the two bulbs and their energy use. We're going to make a series circuit – one big loop in sequence, beginning and ending with the batteries.

1. Place the batteries into the battery clips, making sure the negative end of each battery (the flat end) is inserted into the negative end of each clip (the end with the spring).
2. Connect your battery clips together, end to end, so that the positive end of one clip is inserted into the negative end of the second clip. Make sure they are fully snapped together. [See image 1]
3. The ends of your battery clips have metal edges that stick out. These edges will be your connectors. Use an alligator clip and clip one end to the negative end of the battery clips.
4. Take the black lead that comes with the multimeter, and insert it into the bottom hole on the multimeter. Connect the sharp end of the black lead to the free end of the alligator clip that you connected in step 3 to the batteries. [See image 2]
5. Next, find the red lead that comes with the multimeter and insert it into the top hole on the multimeter. Attach a new alligator clip to the sharp end of the red lead.
6. Attach the other end of this new alligator clip to one of the metal prongs on the light bulb holder.
7. Attach one more alligator clip to the second prong on the light bulb holder. Connect the other end of the alligator clip to the positive side of the batteries. [See image 3] You should now have one, continuous loop from the batteries, to the multimeter, to the bulb holder, and back to the batteries.

IMAGE 1

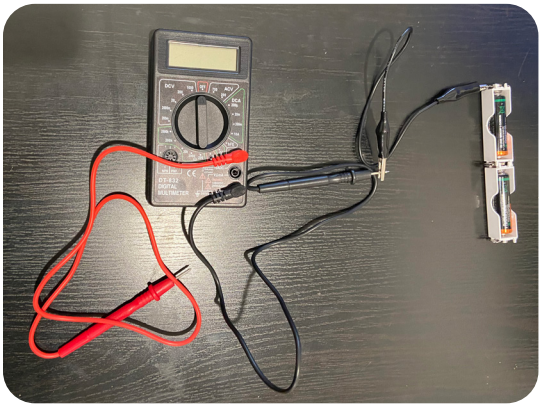


IMAGE 2

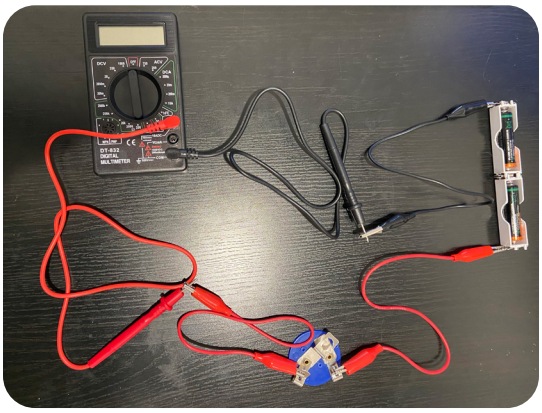


IMAGE 3

PART 2: LIGHT IT UP!

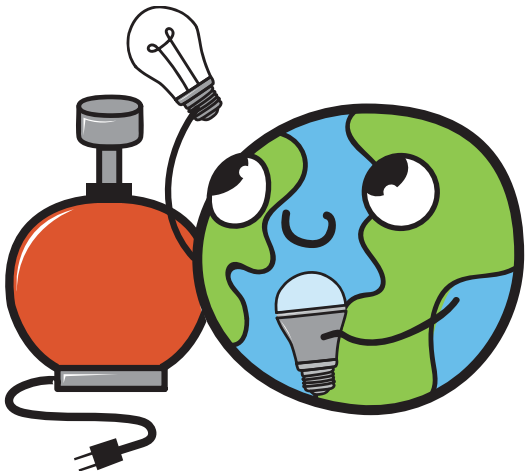
To measure the energy use of each bulb, you will need to screw the bulbs into the bulb holders, one at a time. You will use the multimeter to measure the current in amps in your circuit.

8. Turn on your multimeter by turning the dial to the right. Turn it so that the dial is pointing to the unit "10 A". This will give you a measurement of the current flowing in amps. [See image 4]
9. Connect the incandescent bulb first. The incandescent bulb is the bulb that is rounded at the top. [See image 5] Connect it by screwing it into the hole in your bulb holder. You will know that your circuit is complete if your bulb lights up. Record observations about brightness and record the reading from the multimeter on the Submission Form.
10. Unscrew the incandescent bulb. Now screw in the LED bulb. Record any observations about brightness and record the reading from the multimeter on the Submission Form. **NOTE:** If your LED is not lighting up, unhook the alligator clips from both ends of your battery holders. Rotate your battery holders so the negative end of the battery holder is now facing the other direction. LEDs contain semiconductors, which only allow current to flow in one direction. Reverse the ends of battery holder and you'll be in business.
11. Once you have recorded your data, unscrew the bulb, and disconnect all of the clips and holders. Make sure to switch the multimeter to "OFF." Remove the batteries from the battery holders.

PART 3: CALCULATE!

You might have seen that the current or amps were different between the bulbs. The current is only one piece in the energy use calculation. You also must consider the voltage required to power the bulbs in order to determine the total power, or energy used. To figure out the energy used in Watts, you will need to use the formula W = Volts x Amps.

1. Enter the data collected in part 2 above into the formula section of your submission form.
2. Look at your bulbs up close. At the top of the shiny portion, you will see the voltage for each bulb is 3 volts. Enter this into the data section.
3. Multiply 3 volts by the amps you recorded. How much power is each bulb using in Watts?
4. Answer the questions on the Submission Form and share your form with Eversource by mail or email.



Optional:

Post a photo or a few photos of your family completing the Light Bulb Comparison activity on your social media channels (Facebook, Twitter, Instagram, etc.). Use #HomeEnergyChallengeUI and tag United Illuminating Company on Facebook and Twitter/X (**@UnitedIlluminating**) and Southern CT Gas on Twitter/X (**@southernctgas**).

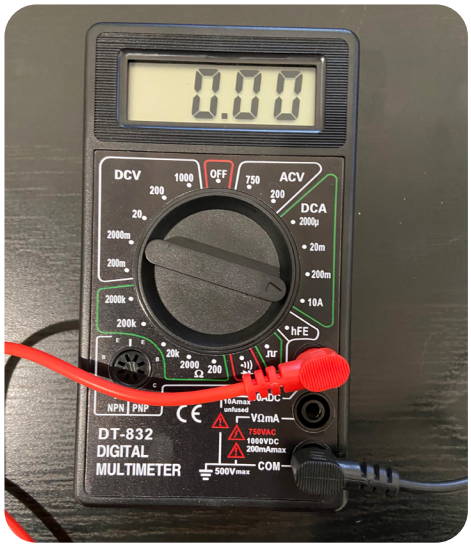
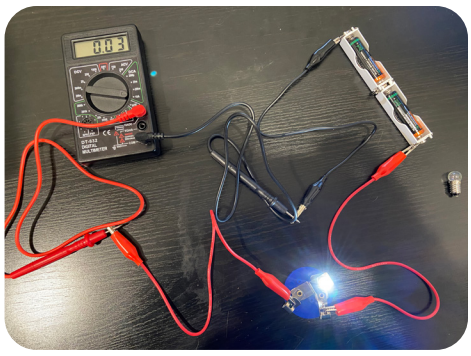
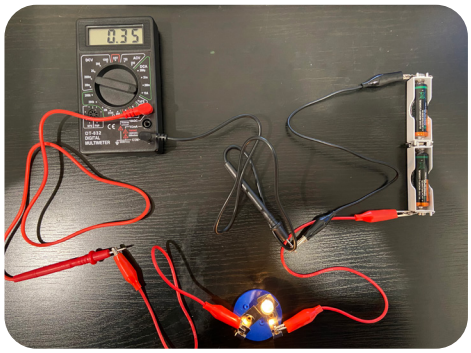


IMAGE 4



LED



INCANDESCENT

Final Data Collection & Submission Form

Submit this form to share your data and photos of your family completing the Home Energy Challenge Light Bulb Comparison Activity to be entered in our prize drawing.

Student Name: _____

Student Address: _____

Student Grade: _____ School:_____

Parent Email:_____Parent Phone Number: _____

Data

	Amps	Brightness Notes
Incandescent		
LED		

INCANDESCENT: W = 3 volts x _____ amps

W = _____

LED: W = 3 volts x _____ amps

W = _____

1. Which bulb uses more energy?
2. If you had to choose between incandescent bulbs or LED bulbs to light your entire home, which would you choose and why?

3. Email or mail this form and pictures of your student working on the project to win an iPad. Submissions are due on or before October 30, 2024:

   Email: info@homeenergychallengeUI.com

   Mail: Home Energy Challenge
   P.O. Box 206 Fairfield, CT 06824-9903
   ATTN: Joe Pymm

4. Optional: Post a photo of your circuit on your social media channels (Facebook, Twitter, Instagram, etc.). Use #HomeEnergyChallengeUI and tag United Illuminating Company on Facebook *@United Illuminating* and Twitter (X) *@unitedillum* and SCG on Twitter (X) *@southernctgas*. *Posting on social media does not increase your chances of winning.*

x _____

By signing this form I confirm that I am a legal U.S. resident residing in one Connecticut community listed in the Official Rules, am eighteen (18) years of age or older, and am a parent or guardian of a current student in grades K-12. Visit our website for official rules **www.homeenergychallengeUI.com.**