

How Bright is Your Light???

Introduction:

You have been exploring energy and power. Up to now, you have learned that electrical appliances that require more power also require more energy.

Today you will be studying light bulbs. Light bulbs have a single, obvious function (to give light, of course!), but they use different rates of energy transfer (power). Why do different light bulbs require different amounts of power? Is there a benefit to either high- or low-powered bulbs? You have learned that different light bulbs require different amounts of power. These are the types of issues you will begin to explore today.

The Experiment:

All light bulbs are designed to brighten a room, but some do it more effectively than others. We can measure a light bulb's illumination (or "brightness") with a device called a light sensor. Today, you will use a light sensor to determine the illumination of several different light bulbs.

Hypothesis:

- 1) What do you expect the relationship between a bulb's power requirement and the illumination it emits to be?
- 2) What differences between different types of bulbs (incandescent, halogen, fluorescent, etc.) do you expect to see? Describe the differences you expect to experience.

Procedure:

- 1) At your lab station, make sure a light sensor is set up and is facing the light bulb stand in the center of the room. Make sure the light sensor is connected to "CH 1" on your Lab Pro. Be sure your LabPro has power and is connected via USB to the computer that you are using.
- 2) Open the file called "Bright Light" from the experiments folder in the dock.
- 3) Using a tape measure, measure the distance from your light sensor to the light bulb on the stand. Record this value on your data sheet.

We're going to measure the illumination of several types of bulbs and several power ratings for each.

For each type of bulb, press *COLLECT* once and then use the *KEEP* button to record illumination for each bulb. Push *STOP* only after the entire set of a particular type of bulb is complete.

- 4) Press "Collect", or the green button on the top right of the screen.
- 5) Your teacher will put a light bulb on the stand in the center of the lab and announce what type of light it is and what its power consumption is. Write down the power rating for the bulb into your data table on the back of this sheet. Be sure to record the data in the correct column (frosted incandescent, unfrosted incandescent, halogen, or compact fluorescent).
- 6) When the classroom lights are turned off, press the 'KEEP' button. This is the blue one that looks like a camera shutter. After entering the power value, the bulbs luminosity should be automatically recorded in the data table.

- 7) Repeat this process (steps 5 and 6) for all of the bulbs of this type. When all the bulbs of this type are done, press *STOP*. Then this latest data set needs to be saved. Go to the “Experiment” menu and choose *STORE LATEST RUN*. Then, to give this run an appropriate name, choose *DATA SET OPTIONS* from the “Data” menu. Name the run with the light bulb type. Whatever name is chosen here will end up on your graph’s legend.
- 8) To run another set of light bulbs of another type, return to steps 4-7.
- 9) After all four sets of data are collected, be sure to *SAVE* your file to the *DESKTOP*, and include student last names and the class period number in the filename.
- 10) *PRINT* one copy of the graph for the group. (choose “Print Graph” in the file menu.)

Data:

Lab Station Number: _____

Distance from light sensor to bulb: _____ meters

Incandescent Frosted	
Power (W)	Illumination (Lux)

Incandescent Unfrosted	
Power (W)	Illumination (Lux)

Compact Fluorescent	
Power (W)	Illumination (Lux)

Halogen	
Power (W)	Illumination (Lux)

Analysis:

Using LoggerPro and the data you have collected, examine the plot of illumination as a function of power. Adjust the graph so that the vertical axis includes a reasonable range for the data collected. Be sure that the origin remains a part of the graph.

1. Describe the general shape of the illumination vs. power plots.
2. Explain the differences in the shapes that exist for the various types of bulbs examined.
3. What benefits are there to using particular amounts of power for light bulbs? That is...why would one choose a higher or lower power value for a light bulb?
4. What benefits are there to using particular types of light bulbs? That is...why would one choose a particular type of light bulb over a different type?
5. Name a few key factors that influence people’s decisions about what types of bulbs that are used regularly.