





## Shedding Light on Light Bulbs

Today's consumer has a considerable collection of choices with regards to light bulbs used in lamps and overhead lighting. **Table 1** summarizes some of the options.

**Table 1**

Bulb Type	Relative Cost	Lumen/Watt	Life Span	Color Temp.	Remarks
Incandescent 	Low	15	750 - 1000 hrs	2700 K	Most traditional bulb; use is banned in the USA by 2014.
Halogen 	Medium	25	3000 hrs	3000 K	Very bright bulb. Produces excessive heat; not practical for children's rooms.
CFL 	Medium	60	10000 hrs	2700 K – 6500 K	CFL = compact fluorescent light. Do not get hot. Contains mercury.
LED 	High	45	45000 hrs	2700 K – 6500 K	LED = light emitting diode. Do not get hot.

Source: Adapted from <http://ext.homedepot.com/shopping-tools/light-bulbs/bulbcomparison.html>.

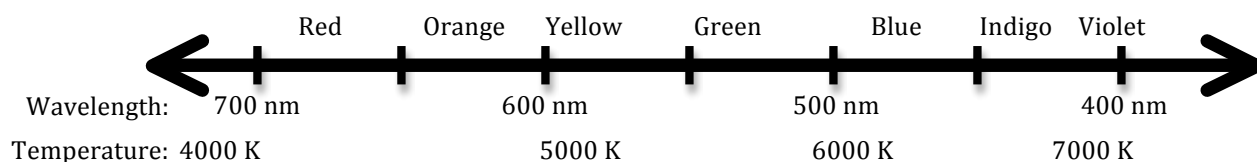
NOTE: The unit *lumens* refers to the intensity of light that is emitted by the light bulb. The unit *Watts* refers to the amount of electrical energy consumed by the light bulb.

One characteristic worth further discussion is the color temperature of the bulb. The white light from a bulb is an indication that all the colors of visible light are present. Yet the light from some bulbs is *richer in blue light*; that is, they are more concentrated with blue. These bulbs have a lower color temperature and are referred to as *cool lights*. Other bulbs have a *warmer* hue and are richer in yellow, orange and red colors. **Table 2** lists a variety of light sources and their color temperature. **Figure 1** shows the various wavelengths of the visible light spectrum and their color temperature (in Kelvin).

**Table 2**

Source	Color Temp.
Match flame	1700 K
Candle flame	1850 K
Moonlight	4100 K
Natural daylight	5000 K
Overcast daylight	6500 K

**Figure 1**



The light bulb images are from The Home Depot website:

<http://ext.homedepot.com/shopping-tools/light-bulbs/bulbcomparison.html>

### Questions:

1. An efficient light bulb produces a large amount of light while using a relatively small amount of electricity. Which bulb type in **Table 1** is most energy efficient?
  - a. Compact fluorescent
  - b. Halogen
  - c. Incandescent
  - d. Light emitting diode
2. Which column in **Table 1** would provide the best measure of the daily (or monthly) operating cost of a light bulb?
  - a. The **Relative Cost** column
  - b. The **Lumen/Watt** column
  - c. The **Life Span** column
  - d. The **Color Temperature** column
3. Mrs. Penny Pincher wishes to spend as little money as possible on her household lighting. What should she look for when buying a bulb?
  - a. A low relative cost, a low lumen/watt, and a short lifespan.
  - b. A low relative cost, a low lumen/watt, and a long lifespan.
  - c. A low relative cost, a high lumen/watt, and a short lifespan.
  - d. A low relative cost, a high lumen/watt, and a long lifespan.
4. LED bulbs are abnormally expensive. Why would a consumer want to buy such a bulb instead of a compact fluorescent bulb?
  - a. They have a shorter life span.
  - b. There is a good range for color temperature.
  - c. Its fun to show the kids a diode that emits light.
  - d. They cost less to operate and they do not have to be replaced as frequently.
5. Suppose that the 100-Watt incandescent bulb in a lamp is being replaced by a compact fluorescent bulb. What wattage bulb must be purchased in order for the lamp to be just as bright?
  - a. A 25 Watt bulb
  - b. A 60 Watt bulb
  - c. A 100 Watt bulb
  - d. A 600 Watt bulb
6. Which wavelength of visible light would give a light bulb a *cooler* feel?
  - a. 400 - 500 nm
  - b. 500 - 600 nm
  - c. 600 - 700 nm
  - d. This is not related to wavelength.
7. How do increases in the wavelength of light affect the color temperature?
  - a. Increasing the wavelength causes the color temperature to increase.
  - b. Increasing the wavelength causes the color temperature to decrease.
  - c. Increasing the wavelength has no affect upon the color temperature.
  - d. Increasing the wavelength causes the color temperature to first increase, then decrease.

8. According to **Table 1** and **Figure 1**, which bulb emits light concentrated with the longest wavelengths - an incandescent bulb or a halogen bulb?
- The light from an incandescent bulb is more concentrated with longer wavelengths.
  - The light from a halogen bulb is more concentrated with longer wavelengths.
  - There is not enough information to make a comparison of the wavelengths.
  - Neither light bulb emits waves of light. The light is straight for both bulbs.
9. Which ordering of colors is arranged from longest to shortest wavelength?
- Orange, blue, green
  - Red, yellow, orange
  - Red, indigo, blue
  - Yellow, green, blue
10. **Figure 1** represents the colors and wavelengths of the visible light spectrum. Other electromagnetic waves that are not visible to the human eye would extend to the left of the red and to the right of the violet. For instance, infrared radiation lies to the left of red and ultraviolet radiation lies to the right of violet. Given this fact, which of the following statements describes the match flame that is listed in **Table 2**?
- The match flame is mostly concentrated with infrared radiation.
  - The match flame consists mostly of wavelengths that are shorter than violet light.
  - The radiation released by a match flame is concentrated with red and orange light.
  - Most of the electromagnetic radiation that is given off by a match flame can be seen.