

Periodic Graphics

A collaboration between C&EN and
Andy Brunning, author of the popular
graphics blog **Compound Interest**

More
online

To see more of
Brunning's work, go to
compoundchem.com.
To see all of C&EN's
Periodic Graphics,
visit [cenm.ag/
periodicgraphics](http://cenm.ag/periodicgraphics).

HOW DIFFERENT LIGHT BULBS WORK

When it comes to lighting your home, you have several choices. Here, we shine a light on how different bulbs work and compare their characteristics: longevity, cost, and energy efficiency.

INCANDESCENT BULBS



1,000 HOURS



COST/HOUR



15 LUMENS/WATT



INERT GAS

Ar and/or N₂

FILAMENT

Tungsten (W)

These bulbs create light by passing current through a tungsten filament to heat it to 2,700 °C. The inert gas prevents the filament from oxidizing and evaporating.

HALOGEN BULBS



3,000 HOURS



COST/HOUR



25 LUMENS/WATT



GAS ENVELOPE

I₂/Br₂ and Kr/Xe

FILAMENT

Tungsten (W)

In this type of incandescent bulb, the inert gas mix contains a halogen, which helps redeposit tungsten as it evaporates. This way, the bulb can operate at a higher temperature.

COMPACT FLUORESCENT LIGHT BULBS (CFLs)



10,000 HOURS



COST/HOUR



60 LUMENS/WATT



GAS MIXTURE

Ar and Hg

GLASS COATING

Phosphor

CFLs create ultraviolet light by passing current through a mix of argon and mercury gas. When the UV light excites the phosphor coating, it produces visible light.

LIGHT-EMITTING DIODE (LED) BULBS



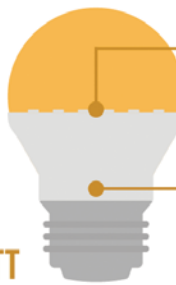
25,000 HOURS



COST/HOUR



80 LUMENS/WATT



LED

Red: AlGaAs

Blue: InGaN

Green: AlGaP

DRIVER CIRCUIT

An electric charge causes an LED's semiconductor materials to emit light. For white light, red, blue, and green LEDs are combined, or blue LEDs are coated with a yellow phosphor.