

Light Intensity

The term **intensity** describes the rate at which light spreads over a given area of a surface some distance from its source. The intensity varies with the distance from and the power of the source. **Power** is a property of the light source that describes the rate at which light energy is emitted by the source. Power is often expressed in units of watts. **Table 1** shows the dependence of intensity (**I**) upon the distance (**r**) from a 60-watt light bulb. Numbers are rounded to the second decimal place.

r (m)	I (W/m ²)
0.10	477.46
0.20	119.37
0.50	19.10
1.00	4.77
2.00	1.19
5.00	0.19
10.00	0.05

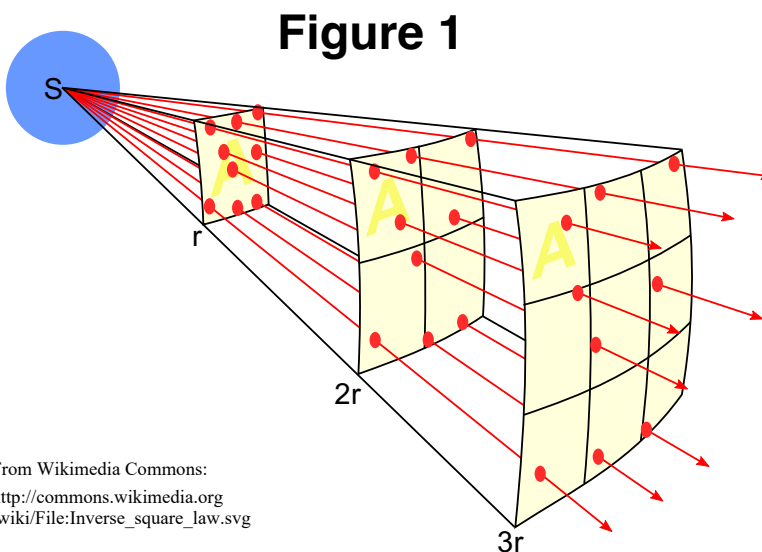
Different light bulbs are rated to have different power values.

Typically, the purpose of a light source determines what power bulb will be used in the source. A night light bulb will have a lower power rating than the light bulb used in a floor lamp. **Table 2** shows the intensity (**I**) at a distance of 1.0 meter from various bulbs.

Table 2: Intensities at 1-m Distances

	Power (W)	I (W/m ²)
Night Light Bulb	7.5	0.60
Vanity Bulb	30	2.39
Appliance Bulb	40	3.18
Desk Lamp	60	4.77
Floor Lamp	100	7.96
3-Way Bulb (Max.)	150	11.94
Work light	1000	79.58

In Physics, the model for explaining how light travels from a source through space is represented in **Figure 1**. Light energy emitted by the source (**S**) travels outward in all directions. The *rays* indicate the straight-line paths of a photon through space. Of course, the greater the distance (**r**) from the source, the further apart that the *rays* become. At a distance **r** from the source, there are nine *rays* passing through the square area. These *rays* carry energy through the surroundings. At distances further from the source, the same energy spreads over a wider area. For example, at a distance of **2r**, these same nine *rays* pass through an area that is four times larger than the original square. Thus, the intensity (rate at which light lands upon a given area of a surface) decreases with increasing distance from the source.



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