Question # 81942

The watt is the derived SI unit of power, the measure of energy per unit time: 1W=1J/s. A semiconductor laser in a CD player has an output wavelength of 780 nm and a power level of 0.10 mW.

How many photons strike the CD surface during the playing of a CD 69 minutes in length?

Answer:

$1.626*10^{18}$ photons strike the CD surface during the 69 minutes of playing.

First of all, it is necessary to calculate the energy produced by a semiconductor laser for 69 minutes:

$$E = 0.1 * 10^{-3} * 69 * 60 = 0.414 \, J$$

Next, it is possible to calculate the number of photons striking the CD surface during this time:

$$E = \frac{n * h * c}{\lambda}$$

$$n = \frac{E * \lambda}{c * h} = \frac{0.414 * 780 * 10^{-9}}{6.62 * 10^{-34} * 3 * 10^{8}} = 1.626 * 10^{18}$$

Consequently, $1.626*10^{18}$ photons strike the CD surface during the 69 minutes of playing.