Name STURMAN key 7=6

$E = h\nu$
$\nu = c/\lambda$
$h = 6.63 * 10^{-34}$ J-s
$c = 3.00 * 10^{8}$ m/s

Practice with Planck's Theory

1. The laser bar-code scanners used at stores and supermarkets emit orange-red light of wavelength 633 nm. What is the energy of a single photon of this light?

*Remember, wavelength must be converted to meters- 1 nm is equal to 10^{-9}

+2

$\lambda = 633\text{nm} = 633\times10^{-9}\text{m}$

$E = ?$

$c = f\lambda$

$3.00\times10^{8} = f(633\times10^{-9})$

$f = 4.74\times10^{14}\,s^{-1}$

$E = hf$

$= 6.63\times10^{-34}(4.74\times10^{14})$

$= \boxed{3.14\times10^{-19}\text{ J}}$

Use above answer. +2

The laser in a typical bar-code scanner emits 10^{-3} joules of light energy per second. How many number of photons are emitted per second?

$\frac{1\times10^{-3}\text{ J}}{1\text{ s}} \cdot \frac{1\text{ photon}}{3.14\times10^{-19}\text{ J}} = \boxed{3.18\times10^{15}\text{ photons/sec}}$

+3

2. A lamp emits light with a wavelength of 540 nm. What is the frequency of light emitted by this lamp? What is the energy of a single photon of this light?

$\lambda = 540\text{nm} = 540\times10^{-9}\text{m}$

$f = ?$

$c = f\lambda$

$3.00\times10^{8} = f(540\times10^{-9})$

$\boxed{f = 5.56\times10^{14}\,s^{-1}}$

$\boxed{E = 3.69\times10^{-19}\text{ J/photon}}$

3. A cellular phone is a radio transmitter and receiver. You receive an incoming call in the form of a radio wave of frequency 880.65 MHz. What is the wavelength (in meters) of this wave?

* Remember that mega (M) means 10^{6} Therefore, the frequency is $880.65*10^{6}\ s^{-1}$

+2

$f = 880.65\text{ MHz} = 880.65\times10^{6}\text{ Hz}$

$\lambda = ?$

$c = f\lambda$

$3.00\times10^{8} = 880.65\times10^{6}\,\lambda$

$\boxed{\lambda = .341\text{m}}$

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