Example Of Energy To Color Problem

Answer the following question showing all appropriate work.

What is the wavelength (in nm) of light that has an energy of 3.46 X 10^{-19} J (3.46E-19J)?

BY DIMENSIONAL ANALYSIS

* WHENEVE YOU ARE USING SPEED OF LIGHT CONSTANT ($C = 3.00\times10^{8}\ \frac{m}{s} = 3.00\times10^{8}\ m\cdot Hz$) YOU MUST START WITH MATERIAL IN DENOMINATOR

1. λ (nm)?
2. 3.46×10^{-19} J
   $3.00\times10^{8}\ m\cdot Hz$
   $6.60\times10^{-34}\ \frac{J}{Hz}$

$$\left(\frac{1}{3.46\times10^{-19}\ J}\right)\left(6.60\times10^{-34}\ \frac{J}{Hz}\right)\left(3.00\times10^{8}\ m\cdot Hz\right)\left(\frac{1\times10^{9}\ nm}{1\ m}\right) = 572.2\ nm = 572\ nm$$

BY EQUATION

1st Equation

$E = 3.46\times10^{-19}$ J

$h = 6.60\times10^{-34}\ \frac{J}{Hz}$

$E = h\cdot f \Rightarrow f = \frac{E}{h}$

$$f = \frac{3.46\times10^{-19}\ J}{6.60\times10^{-34}\ \frac{J}{Hz}} = 5.242\times10^{14}\ Hz$$

2nd Equation

$f = 5.242\times10^{14}\ Hz$

$c = 3.00\times10^{8}\ m\cdot Hz$

$\lambda\cdot f = c \Rightarrow \lambda = \frac{c}{f}$

$$\lambda = \frac{3.00\times10^{8}\ m\cdot Hz}{5.242\times10^{14}\ Hz}$$

$$\lambda = 5.723\times10^{-7}\ m\left(\frac{1\times10^{9}\ nm}{1\ m}\right)$$

$= 572.3\ nm$

$= 572\ nm$