NAME Key

Chemistry Worksheet - Wavelength, frequency, & energy of electromagnetic waves.

Show ALL equations, work, units, and significant figures in performing the following calculations. Identify the type of radiation in each problem. (Use your electromagnetic spectrum)

$C = f\lambda$ $\quad E = hf$

$C = 3.00 \times 10^8$ m/s $\quad h = 6.626\,2 \times 10^{-34}$ J-s (or J/Hz)

1. What is the wavelength of a 2.99 Hz wave?

$C = f\lambda$

$3.00 \times 10^8 \frac{m}{s} = 2.99/s \cdot \lambda$

$1.00 \times 10^8 \text{ m} = \lambda$

2. What is the frequency of a $7.43 \times 10^{-5}$ m wave?

$C = f\lambda$

$3.00 \times 10^8 \frac{m}{s} = f\,(7.43 \times 10^{-5} m)$

$0.404 \times 10^{13}/s = f$

$4.04 \times 10^{12}/s = f$

3. What is the wavelength of a $4.34 \times 10^{15}$ /s wave?

$C = f\lambda$

$3.00 \times 10^8 \frac{m}{s} = 4.34 \times 10^{15}/s \cdot \lambda$

$0.691 \times 10^{-7} m = \lambda$

$6.91 \times 10^{-8} m = \lambda$

4. What is the frequency of a $5.6 \times 10^{10}$ μm wave? (μm X $10^{-6}$ = m)

① $5.6 \times 10^{10}\,\mu m \frac{1 \times 10^{-6} m}{1\,\mu m} = 5.6 \times 10^4 m$

② $C = f\lambda$

$3.00 \times 10^8 \frac{m}{s} = f\,5.6 \times 10^4 m$

5. What is the energy of a 7.66 x $10^{14}$ Hz wave? $E = hf$

$E = 6.626 \times 10^{-34} J\text{-}s\,(7.66 \times 10^{14}/s)$

$E = 50.755 \times 10^{-20} J$

$= 50.8 \times 10^{-20} J$

$= 5.08 \times 10^{-19} J$

6. What is the frequency of a wave carrying $8.35 \times 10^{-18}$ J of energy?

$E = hf$

$8.35 \times 10^{-18} J = (6.626 \times 10^{-34} J \cdot s) f$

$1.26022 \times 10^{+16} / s = f$

$1.26 \times 10^{+16} / s$

7. What is the frequency of a $1.78 \times 10^{-15}$ J wave?

$E = hf$

$1.78 \times 10^{-15} J = 6.626 \times 10^{-34} J \cdot s \, f$

$0.269 \times 10^{19} / s = f$

$2.69 \times 10^{18} / s = f$

8. What is the wavelength of a $7.65 \times 10^{-17}$ J wave?

$E = hf$

$7.65 \times 10^{-17} J = 6.626 \times 10^{-34} J s \cdot f$

$1.15 \times 10^{17} / s = f$

$c = f\lambda$

$3.00 \times 10^{8} m/s = 1.15 \times 10^{17} / s \cdot \lambda$

$2.6 \times 10^{-9} m = \lambda$

9. What is the wavelength of a $1.32 \times 10^{-6}$ J wave?

$E = hf$ or $E = h\frac{c}{\lambda}$

$1.32 \times 10^{-6} J = \frac{(6.626 \times 10^{-34} J \cdot s)(3.00 \times 10^{8} m/s)}{\lambda}$

$1.32 \times 10^{-6} J \cdot \lambda = (6.626 \times 10^{-34} J \cdot s)(3.00 \times 10^{8} m/s)$

$1.32 \times 10^{-6} J \cdot \lambda = 19.9 \times 10^{-26} J \cdot m$

$\lambda = \frac{1.9.9 \times 10^{-26} J \cdot m}{1.32 \times 10^{-6} J}$

$\lambda = 15.08 \times 10^{-20} m$

$= 1.51 \times 10^{-19} m$