AP Chem: UNIT II – EM Radiation Practice

Hamilton H.S. 1st Trimester

Name: ANS KEY Date: _____

ELECTROMAGNETIC RADIATION
WAVELENGTH AND FREQUENCY CALCULATIONS

λ = wavelength ν = frequency h = Planck's constant E = energy

$c = \lambda\nu$ $E = h\nu$ $E = \frac{hc}{\lambda}$ $c = 3 \times 10^8$ m/s $h = 6.626 \times 10^{-34}$ Js

Complete the following calculations using the relationship among wavelength, frequency, and the speed of light.

1. Determine the frequency of light with a wavelength of 675nm (Convert to meters first. 1m = 1,000,000,000 nm)

$\nu = \frac{c}{\lambda}$

$\frac{3.00 \times 10^8 \text{ m s}^{-1}}{675 \times 10^{-9} \text{ m}} = 4.44 \times 10^{14} \text{ s}^{-1}$

2. Determine the frequency of light with a wavelength of 4.50×10^{-7}m.

$\nu = \frac{c}{\lambda}$

$\frac{3.00 \times 10^8 \text{ m s}^{-1}}{4.50 \times 10^{-7} \text{ m}} = 6.67 \times 10^{14} \text{ s}^{-1}$

3. What is the wavelength of an X ray that has a frequency of 7.8×10^{17} Hz?

$\lambda = \frac{c}{\nu}$

$\frac{3.00 \times 10^8 \text{ m s}^{-1}}{7.8 \times 10^{17} \text{ s}^{-1}} = 3.8 \times 10^{-10} \text{ m} \; (0.38 \text{ nm})$

4. What is the wavelength of a light wave with a frequency of 8.96×10^{14}Hz?

$\lambda = \frac{c}{\nu}$

$\frac{3.00 \times 10^8 \text{ m s}^{-1}}{8.96 \times 10^{14} \text{ s}^{-1}} = 3.35 \times 10^{-7} \text{ m} \; (335 \text{ nm})$

5. A form of electromagnetic radiation is traveling with a frequency of 3.61×10^6Hz. What is the wavelength?

$\lambda = \frac{c}{\nu}$

$\frac{3.00 \times 10^8 \text{ m s}^{-1}}{3.61 \times 10^6 \text{ s}^{-1}} = 83.1 \text{ m}$

6. What is the frequency of a microwave that has a wavelength of 116.3 m?

$\nu = \frac{c}{\lambda}$

$\frac{3.00 \times 10^8 \text{ m s}^{-1}}{116.3 \text{ m}} = 2.580 \times 10^6 \text{ Hz}$

7. What is the frequency of a light wave that has a wavelength of 470 nm?

$\nu = \frac{c}{\lambda}$

$\frac{3.00 \times 10^8 \text{ m s}^{-1}}{470 \times 10^{-9} \text{ m}} = \cancel{6.38 \times 0}$

$6.4 \times 10^{14} \text{ Hz}$

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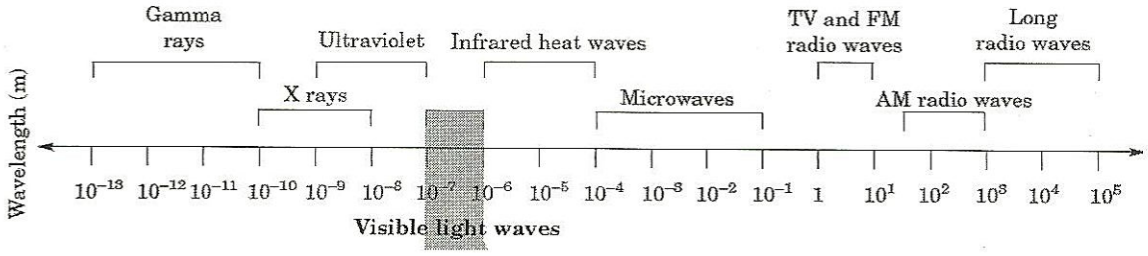

- Violet: 400-430 nm (4.00×10^{-7}-4.30×10^{-7}m)
- Indigo: 430-450 nm (4.30×10^{-7}-4.50×10^{-7}m)
- Blue: 450-500 nm (4.50×10^{-7}-5.000×10^{-7}m)
- Green: 500-570 nm (5.00×10^{-7}-5.70×10^{-7}m)
- Yellow: 570-590 nm (5.70×10^{-7}-5.90×10^{-7}m)
- Orange: 590-610 nm (5.90×10^{-7}-6.10×10^{-7}m)
- Red: 610-700 nm (6.10×10^{-7}-7.00×10^{-7}m)

8. Using the figures above, what color is the light wave from question 7?

Blue

9. What is the frequency of an electromagnetic wave that has a wavelength of 72.6 nm (Convert to meters first)?

$\nu = \frac{c}{\lambda}$

$\frac{3.00\times10^{8}\ m\ s^{-1}}{72.6\times10^{-9}\ m} = 4.13\times10^{15}\ Hz$

10. Using the figures above what kind of electromagnetic radiation is used in question 9?

X-rays (I would accept UV.)

11. What is the wavelength of an electromagnetic wave that has a frequency of 6.79 X 10^{9}Hz?

$\lambda = \frac{c}{\nu}$

$\frac{3.00\times10^{8}\ m\ s^{-1}}{6.79\times10^{9}\ s^{-1}} = 4.42\times10^{-2}\ m$

12. What is the wavelength of a light wave that has a frequency of 4.42 X 10^{14}Hz?

$\lambda = \frac{c}{\nu}$

$\frac{3.00\times10^{8}\ m\ s^{-1}}{4.42\times10^{14}\ s^{-1}} = 6.79\times10^{-7}\ m\ (679\ nm)$

13. Using the figures above, what color is the light wave from question 12?

~~Blue~~ Red

14. A gamma ray has a wavelength of 0.039 nm. What is the frequency of the wave?

$\nu = \frac{c}{\lambda}$

$\frac{3.00\times10^{8}\ m\ s^{-1}}{0.039\times10^{-9}\ m} = 7.7\times10^{18}\ Hz$