

Name: \_\_\_\_\_

Date: \_\_\_\_\_

**Wave Properties of Light**

**Electromagnetic Spectrum**

Radio  $10^3$  Hz  
TV  $10^6$  Hz

- Energy of one photon with a frequency of  $\nu$
- Speed of light =  $3 \times 10^8$  m/s
- Wavelength  $\lambda = c/\nu$
- Frequency of the photons or light  $\nu$
- Wavelength of light  $\lambda$

IR  $10^{12}$  Hz  
Visible  $10^{14}$  Hz

**Electromagnetic Spectrum (Wavelengths)**

- $10^3$  m - Radio waves
- $10^6$  m - Microwaves
- $10^9$  m - Infrared
- $10^8$  m - TV/Cell phone
- $10^7$  m - Ultraviolet
- $10^6$  m - Visible light
- $10^8$  m - X-rays
- $10^9$  m - Gamma rays

**Hint: Speed of light**

1. A photon has a frequency ( $\nu$ ) of  $2.00 \times 10^6$  Hz. Calculate its energy.
2. Calculate the energy ( $E$ ) and wavelength ( $\lambda$ ) of a photon of light with a frequency ( $\nu$ ) of  $3.00 \times 10^7$  Hz.
3. Calculate the frequency and the energy of the light that has a wavelength of  $4000$  nm.
4. Calculate the wavelength and energy of light that has a frequency of  $3.3 \times 10^7$  Hz.
5. A photon of light has a wavelength of  $3.0000$  nm. Calculate its energy.
6. Calculate the number of photons having a wavelength of  $300$  nm required to produce  $1.0$  J of energy.
7. Calculate the total energy in  $1.0 \times 10^{17}$  photons of gamma radiation having  $\lambda = 3.0 \times 10^{-11}$  m.
8. Calculate the energy and frequency of red light having a wavelength of  $6.50 \times 10^2$  nm.
9. The wavelength of green light from a traffic signal is centered at  $5.20 \times 10^2$  nm. Calculate the frequency.
10. Calculate the frequency of light that has a wavelength of  $4.20 \times 10^2$  nm. Identify the type of electromagnetic radiation.