

Name: .....

Date: .....

**Wave Properties of Light**

**Electromagnetic Spectrum**

Radio  $3 \times 10^3$  Hz  
 $3 \times 10^4$  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

IR  $3 \times 10^{12}$  Hz  
UV  $3 \times 10^{16}$  Hz

**Electromagnetic Spectrum (Wavelengths)**

- $10^3$  m - Radio waves
- $10^2$  m - Microwaves
- $10^1$  m - Infrared
- $10^0$  m - Visible light
- $10^{-1}$  m - Ultraviolet
- $10^{-2}$  m - X-rays
- $10^{-3}$  m - Gamma rays

**Worked Example 1**

1. A photon has a frequency ( $\nu$ ) of  $3.00 \times 10^{14}$  Hz. Calculate its energy.
2. Calculate the energy ( $E$ ) and wavelength ( $\lambda$ ) of a photon of light with a frequency ( $\nu$ ) of  $6.00 \times 10^{14}$  Hz.
3. Calculate the frequency and the energy of blue light that has a wavelength of 450 nm.
4. Calculate the wavelength and energy of light that has a frequency of  $3.3 \times 10^{17}$  Hz.
5. A photon of light has a wavelength of  $5.00 \times 10^{-7}$  m. Calculate its energy.
6. Calculate the number of photons having a wavelength of 680 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  $\lambda$  of  $5.0 \times 10^{-12}$  m.
8. Calculate the energy and frequency of red light having a wavelength of  $6.50 \times 10^{-7}$  m.
9. The wavelength of green light from a traffic signal is centered at  $5.20 \times 10^{-7}$  m. Calculate the frequency.
10. Calculate the frequency of light that has a wavelength of  $4.20 \times 10^{-7}$  m. Identify the type of electromagnetic radiation.