

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

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

**Wave Functioning in Physics**

**Experimental Evidence**

$E = hf$        $f = \frac{c}{\lambda}$

- 1. Energy of one photon with a frequency of  $f$
- 2. Speed of light =  $3 \times 10^8 \text{ m/s}$
- 3. Planck's constant =  $6.626 \times 10^{-34} \text{ J}\cdot\text{s}$
- 4. Wavelength in meters
- 5. Frequency in Hertz (cycles per second)

10 joules =  $1.0 \times 10^7 \text{ mJ}$   
10 joules =  $1.0 \times 10^4 \text{ kJ}$

**Electromagnetic Spectrum (Wavelengths)**

- radio waves (longest)
- microwaves
- infrared
- visible light
- ultraviolet
- X-rays
- gamma rays (shortest)

**Wave-Particle Duality**

1. A photon has a frequency ( $f$ ) of  $3.00 \times 10^{14} \text{ Hz}$ . Calculate its energy.
  
2. Calculate the energy ( $E$ ) and wavelength ( $\lambda$ ) of a photon of light with a frequency ( $f$ ) of  $3.00 \times 10^{14} \text{ Hz}$ .
  
3. Calculate the frequency and the energy of blue light that has a wavelength of  $450 \text{ nm}$ .
  
4. Calculate the wavelength and energy of light that has a frequency of  $3.3 \times 10^{17} \text{ Hz}$ .
  
5. A photon of light has a wavelength of  $3.00 \times 10^{-7} \text{ m}$ . Calculate its energy.
  
6. Calculate the number of photons having a wavelength of  $300 \text{ nm}$  required to produce  $1.0 \text{ J}$  of energy.
  
7. Calculate the total energy in  $1.0 \times 10^{21}$  photons of gamma radiation having  $\lambda = 3.0 \times 10^{-13} \text{ m}$ .
  
8. Calculate the energy and frequency of red light having a wavelength of  $6.50 \times 10^{-7} \text{ m}$ .
  
9. The wavelength of green light from a traffic signal is centered at  $5.20 \times 10^{-7} \text{ m}$ . Calculate the frequency.
  
10. Calculate the frequency of light that has a wavelength of  $4.20 \times 10^{-7} \text{ m}$ . Identify the type of electromagnetic radiation.