

Name: _____

Date: _____

Wave Properties of Light

Electromagnetic Spectrum

Radio 10^3 Hz
TV 10^8 Hz

- energy of one photon with a frequency of ν
- speed of light = 3×10^8 m/s
- Planck's constant = 6.626×10^{-34} J s
- wavelength in meters
- frequency in Hertz (cycles per second)

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

Electromagnetic Spectrum (Wavelengths)

- radio $> 10^3$ m
- TV 10^2 - 10^3 m
- IR 10^3 - 10^4 m
- Visible 400 - 700 nm
- UV 10^{-8} - 10^{-7} m
- X-ray 10^{-11} - 10^{-8} m
- Gamma $< 10^{-11}$ m

Worked Example

1. A photon has a frequency (ν) of 2.00×10^{14} Hz. Calculate its energy.
2. Calculate the energy (E) and wavelength (λ) of a photon of light with a frequency (ν) of 6.00×10^{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 3.3×10^{17} Hz.
5. A photon of light has a wavelength of 3.00×10^{-7} m. 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 1.0×10^{17} photons of gamma radiation having λ of 3.0×10^{-11} m.
8. Calculate the energy and frequency of red light having a wavelength of 650×10^{-9} m.
9. The wavelength of green light from a traffic signal is centered at 5.05×10^{-7} m. Calculate the frequency.
10. Calculate the frequency of light that has a wavelength of 4.25×10^{-7} m. Identify the type of electromagnetic radiation.