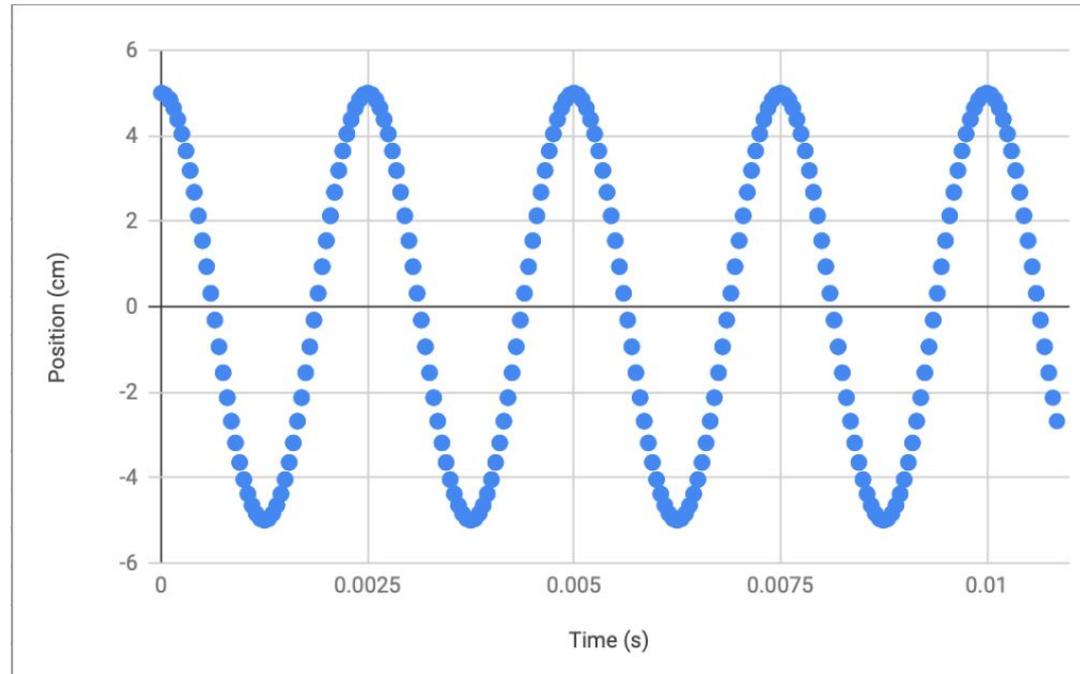


February 26, 2020

Sit with your Light Interaction Lab Group

Entry: What is the equation for this wave?



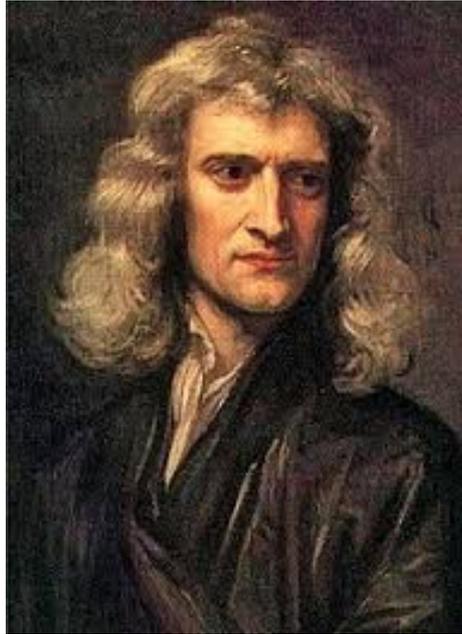
Housekeeping

- Problem Set #10 due on Thursday (A/B) and Friday (C/D)
- Honors Assignment #6 out Thursday
- Honors Meeting at lunch on Friday
- Reminders from Ms. Abdullah
 - Update Naviance
 - Check Portals
 - FAFSA
- Office Hours:
 - Thursday after school 3:30-4:30
 - Friday at lunch

Today

- Light Lab Debrief
- Particle Nature of Light
- Electromagnetic Energy
- Heat Transfer Lab

Particle or wave? - correction

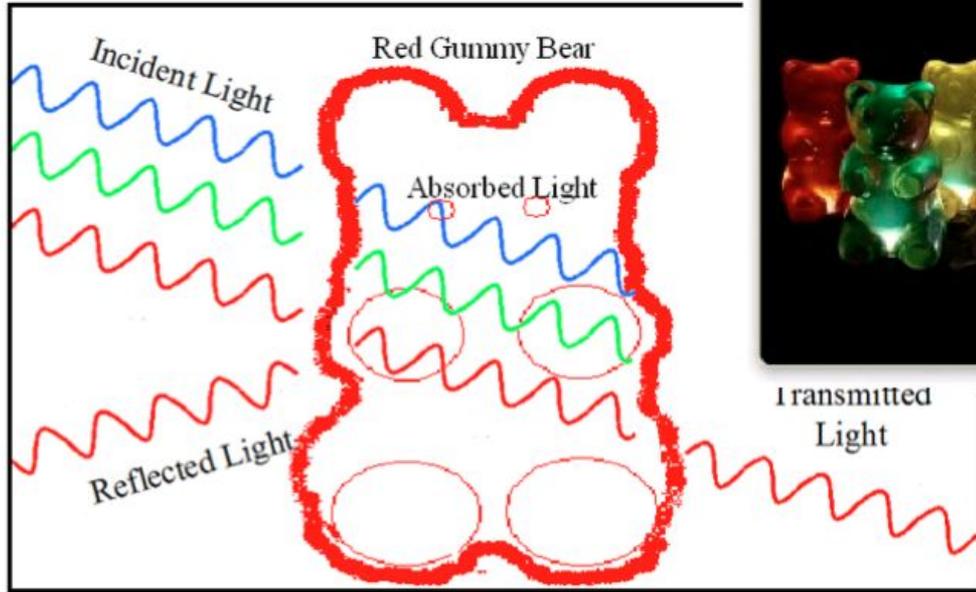


Isaac Newton



Christiaan Huygens

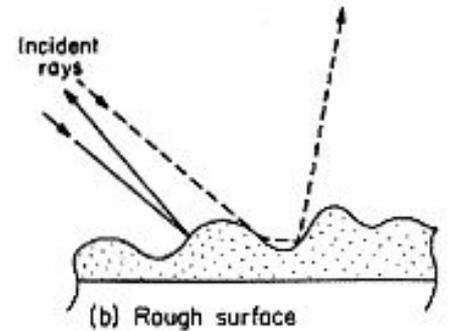
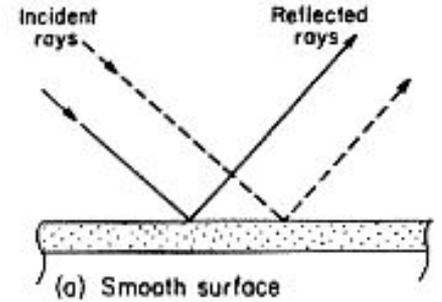
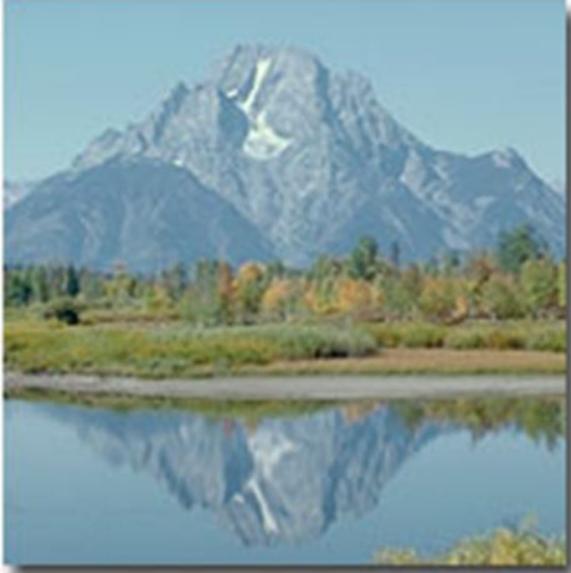
Absorption, Reflection, and Transmission



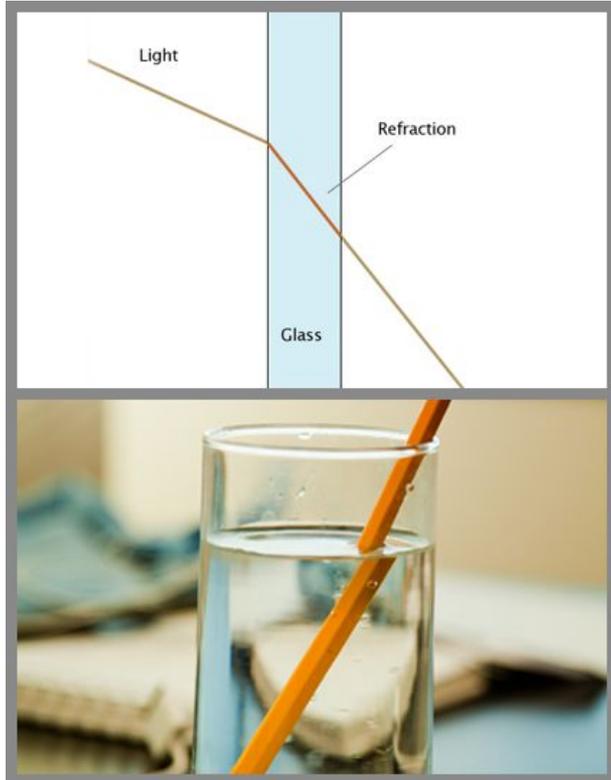
Transmitted Light



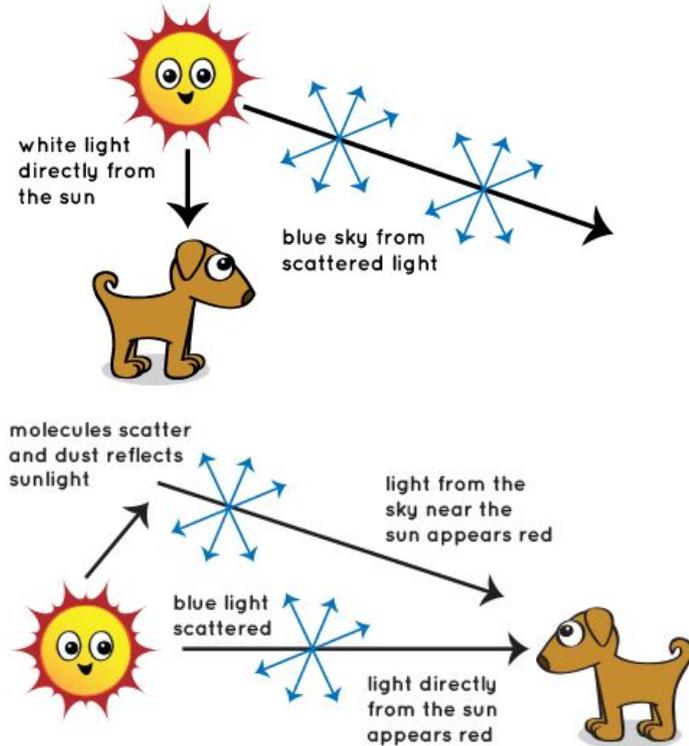
Light Scattering - Diffuse Reflection



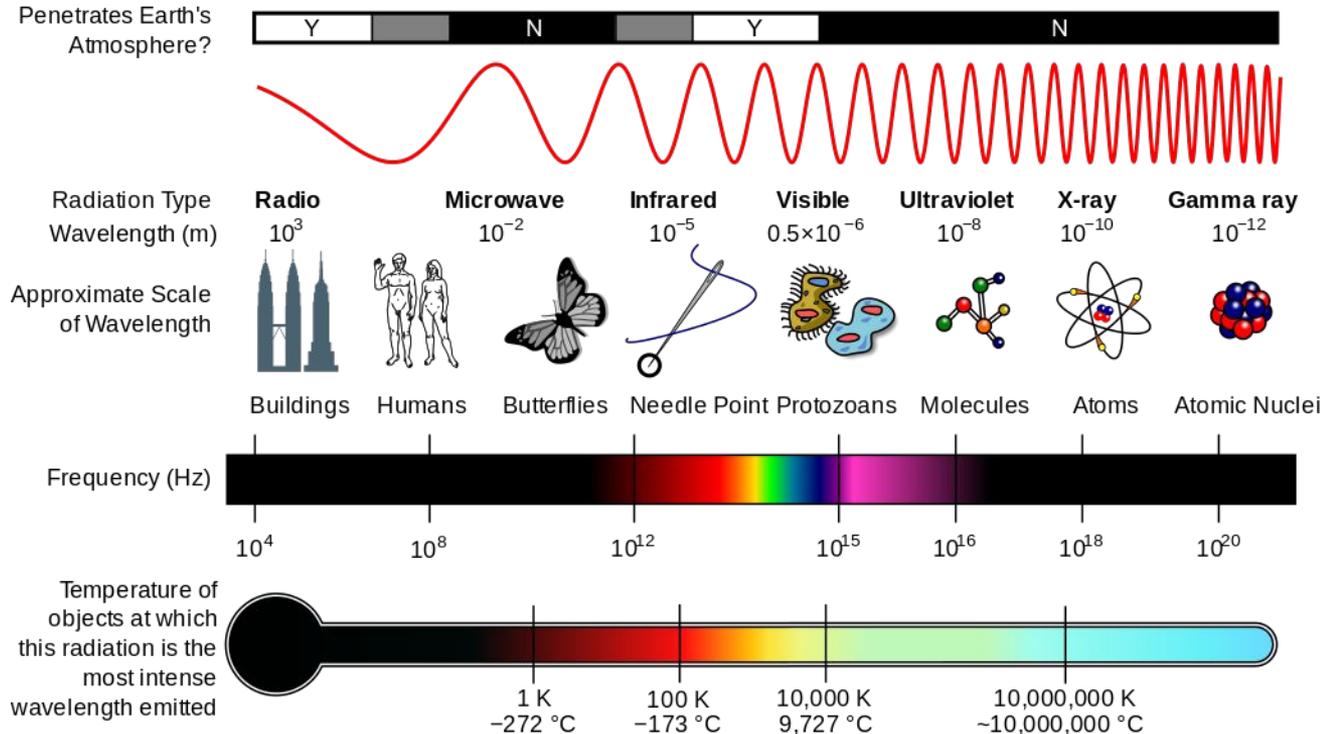
Refraction and More Scattering



Light Scattering - Particles



Electromagnetic Spectrum



How Fast is light really?

Speed of light in a vacuum

$$c = 299,792,458 \text{ m/s} = 2.998 \times 10^8$$

Speed of light in transparent (see through) materials is slower and depends on the frequency/wavelength

Index of Refraction is the ratio of the speed of light in a vacuum to the speed of light in a material

$$n = \frac{c}{v}$$

Implications of Light's Speed in Materials



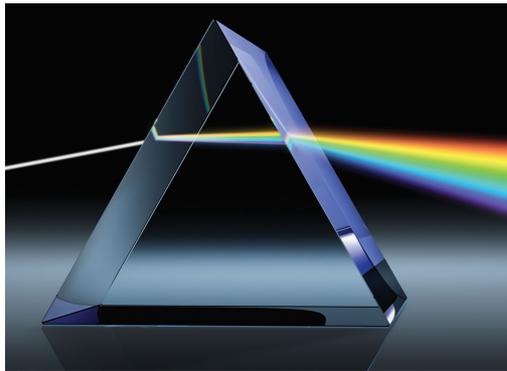
$$n_1 \sin\theta_1 = n_2 \sin\theta_2 \quad |$$

n_1 = material 1 index of refraction

n_2 = material 2 index of refraction

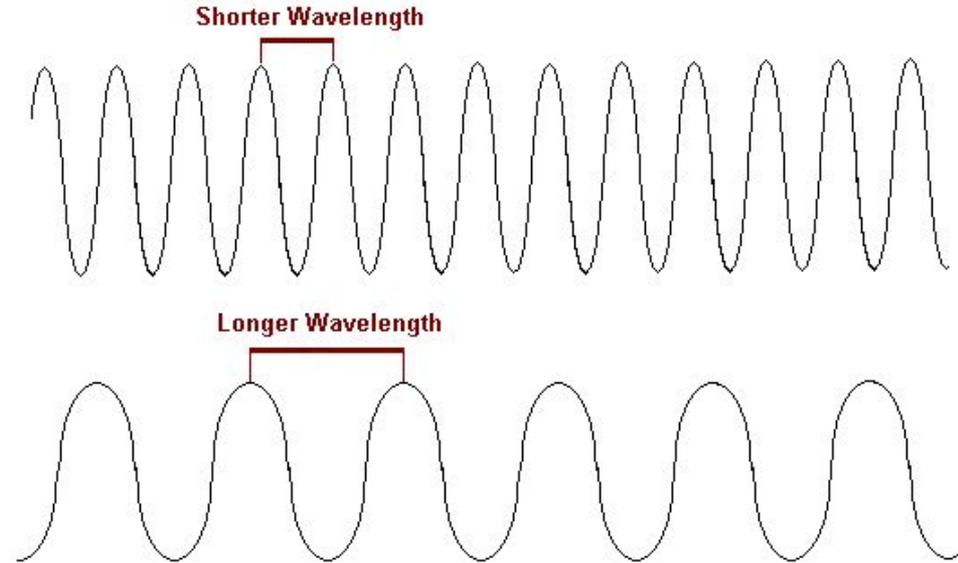
θ_1 = starting angle of incidence

θ_2 = refracted angle



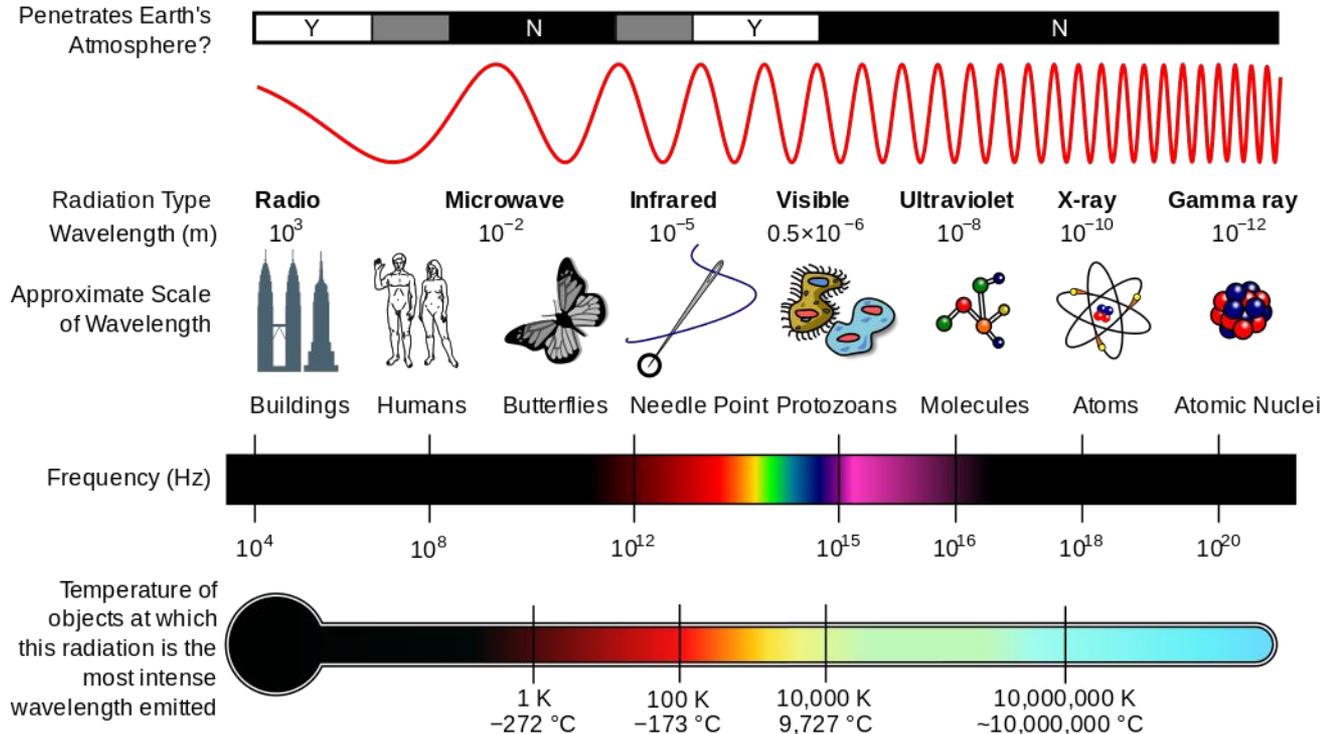
Wavelength

$$c = \lambda f = \lambda \nu$$



ν Is another variable for Frequency

Electromagnetic Spectrum



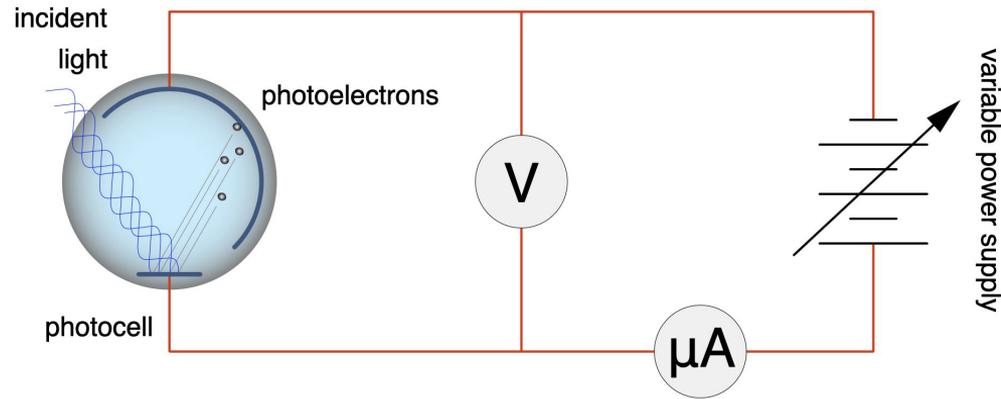
What is a particle?

In physics a particle is a small localized object to which can be ascribed several physical or chemical properties such as volume, density or mass.

In the case of light the property is energy and the particle is called a **photon**

A **photon** is the smallest discrete amount or quantum of electromagnetic radiation. It is the basic unit of all light.

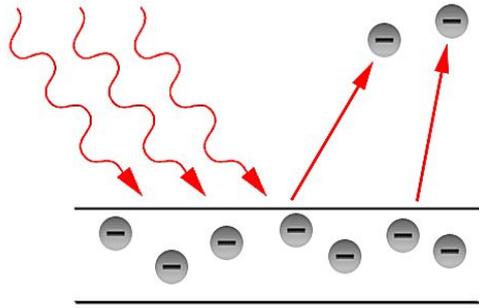
Photoelectric effect - Light as a Particle



First discovered by Heinrich Hertz in 1887 and followed up on by Phillip Leonard, J.J. Thomson, Robert Millikan, and Albert Einstein.

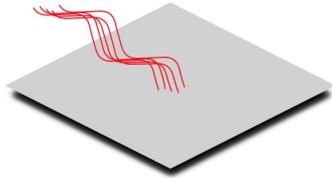
Einstein received the Nobel Prize for his work on it in 1921

Photoelectric Effect - Light as a Particle

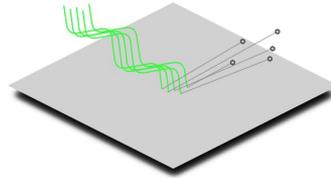


$$K_{max} = h(f - f_0)$$

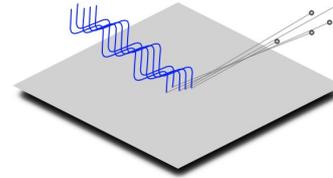
$$K_{max} = E - \phi \quad E = hf = \frac{hc}{\lambda}$$



Red light does not eject photoelectrons (even if it is very bright).

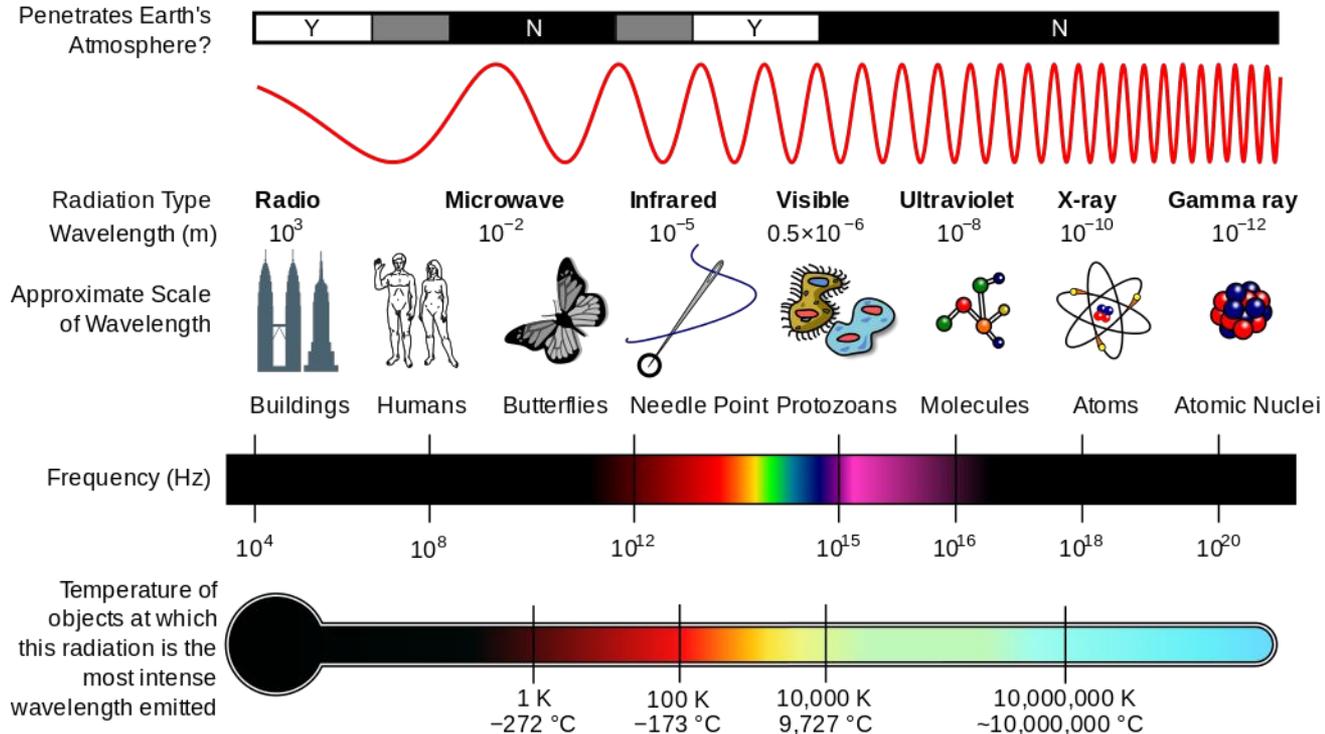


Green light does eject photoelectrons (even if it is very dim).



Blue light ejects photoelectrons with more energy than green light (even if it is very dim).

Electromagnetic Spectrum



Light Energy

Light is made up of massless, chargeless Particles called Photons that behave like a particle and a wave.

A Photon's energy (and that of the light wave) is calculated by:

$$E = hf = h\nu$$

ν Is another variable for Frequency

Calculating Energy in Light

1. What is the energy of each photon of red light that has a frequency of 4.0×10^{14} Hz?
2. Calculate the energy in joules/photon for green light having a wavelength of 550 nm.

Radiative Heat Transfer

Today you will be working with your project group for the first time on a Radiative heat transfer lab.

You will be assigned two bins and you will need to collect temperature data every 2 minutes on each bin.

Divide into 2 smaller groups and have each group assigned to one of the bins.

Between you data collection work on researching your impact.