



# Quantum Mechanics

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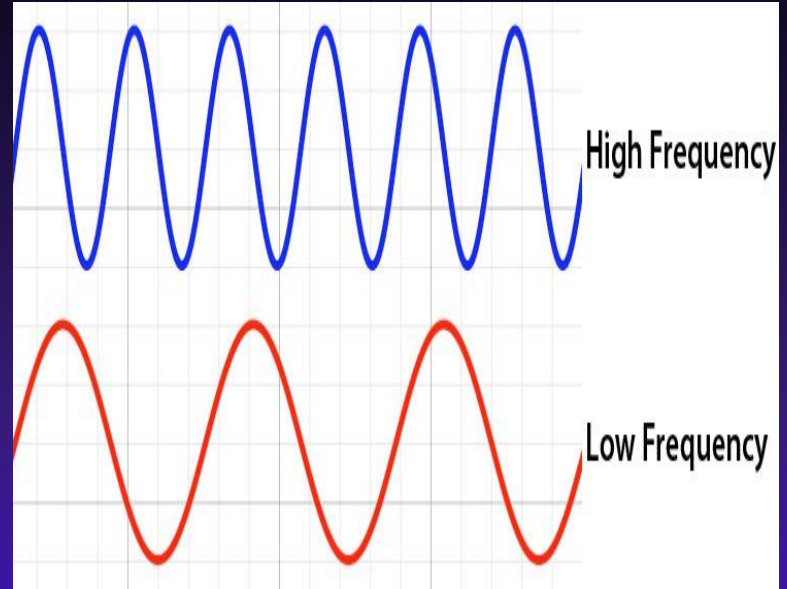
# What is Light?

- Light has **both wave-like and particle-like** properties.
- In the 1600s, a Dutch scientist named Christiaan Huygens showed that light behaves like a **wave** ([Grandinetti.org](http://Grandinetti.org)).



# Properties of Waves

- **Frequency**- The number of crests that pass a given point within 1 second.
- One cycle per second is called a **Hertz (Hz)**.
- Written as  $1/s$  or  $s^{-1}$

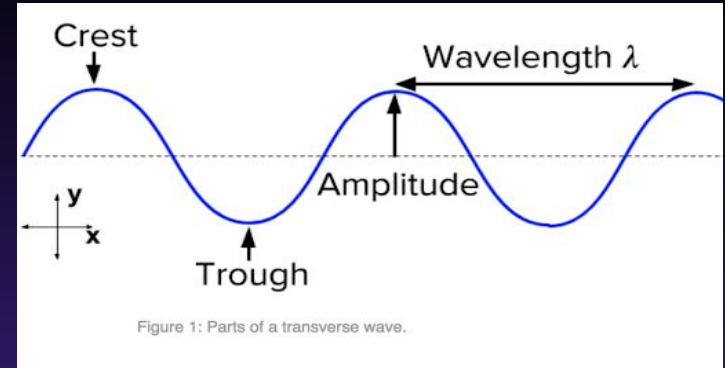


# Properties of Waves

- **Wavelength**- The distance between crests.
- Wavelength and frequency are inversely proportional:

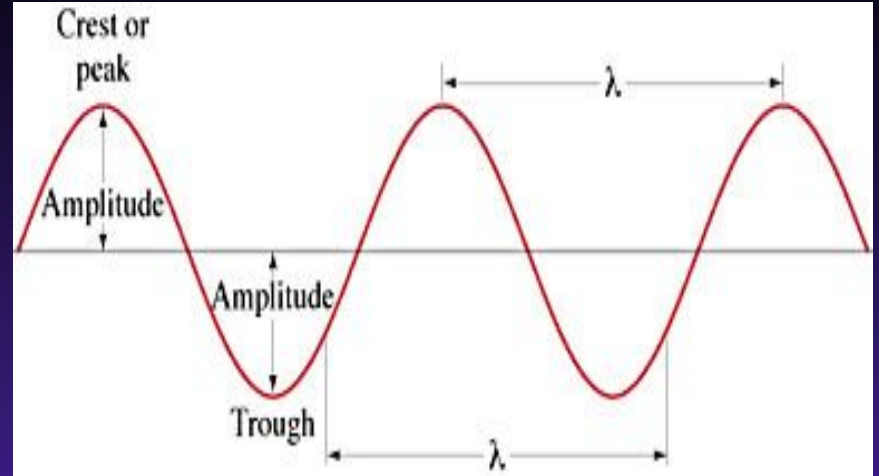
**Shorter wavelength= higher frequency**

- $c = \lambda v$  where  $\lambda$  is wavelength (m),  $v$  is frequency (Hz), and  $c$  is the speed of light ( $3.00 \times 10^8$  m/s)



# Properties of Waves

- **Amplitude**- The vertical distance between the tip of a crest and the wave's central axis. Associated with the brightness or intensity of the wave (nasa.gov).



# Properties of Waves

- **Period**- The length of time it takes for one wavelength to pass by a given point in space (khanacademy.org).

### Period (T) & Frequency (f) (cont)

$$f = \frac{1}{T}$$

The lower the frequency is the longer the time period will be.

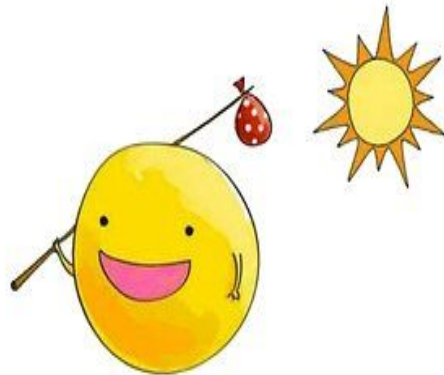
- $T = 1/f$



# What are Photons?

- Light is comprised of **photons**- discrete packets of energy (nasa.gov).
- In other words, 1 photon is a very small amount of light.
- Photons are **quantized**

A PHOTON CHECKS INTO A HOTEL AND IS ASKED  
IF HE NEEDS ANY HELP WITH HIS LUGGAGE



"NO THANKS, I'M TRAVELLING  
LIGHT."

# Photons contd.

- When an atom/molecule loses energy, it emits a photon that carries an energy equal to the loss in energy of the atom/molecule.
- Planck's Equation

$$E = h\nu$$

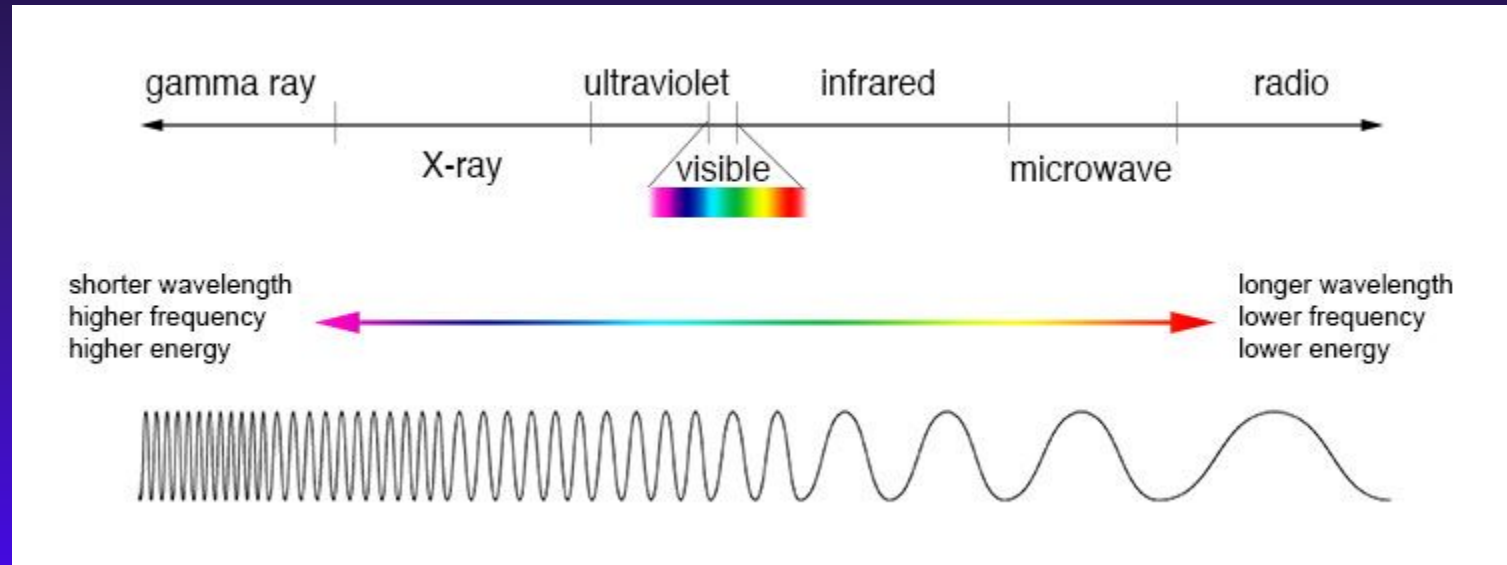
Where E is the energy of the photon absorbed or emitted (J),  $\nu$  is the frequency of the photon (Hz), and h is Planck's constant ( $6.626 \times 10^{-34} \text{ J} \cdot \text{s}$ )





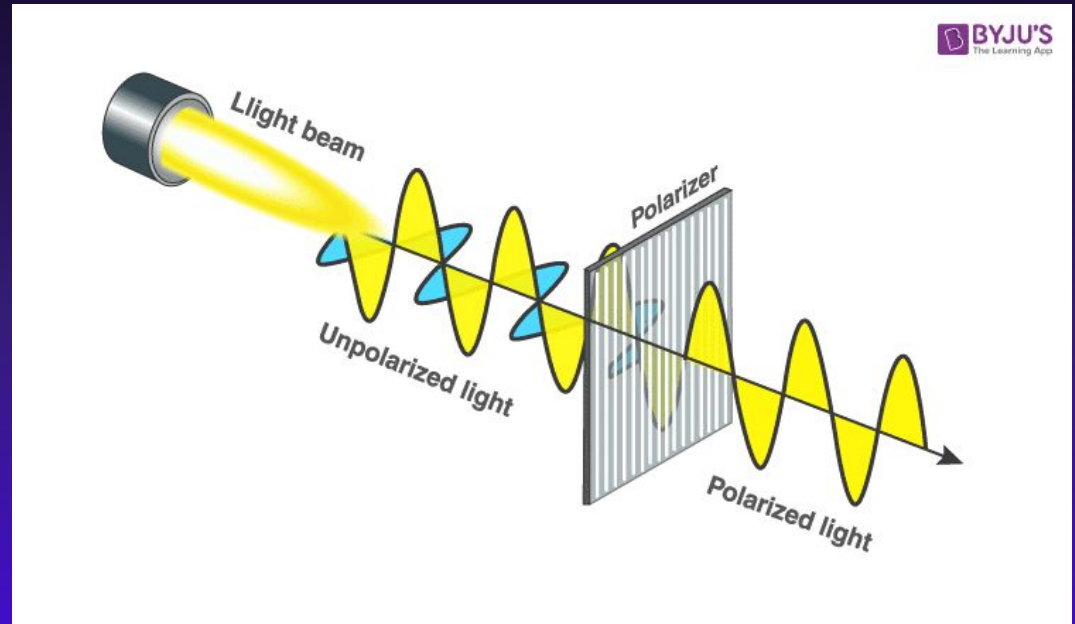
# The Electromagnetic Spectrum

- Defined as the classification of electromagnetic waves according to their various **wavelengths/frequencies**.



# What are Polarizers?

<https://www.youtube.com/watch?v=MhhHPOxTUy8>



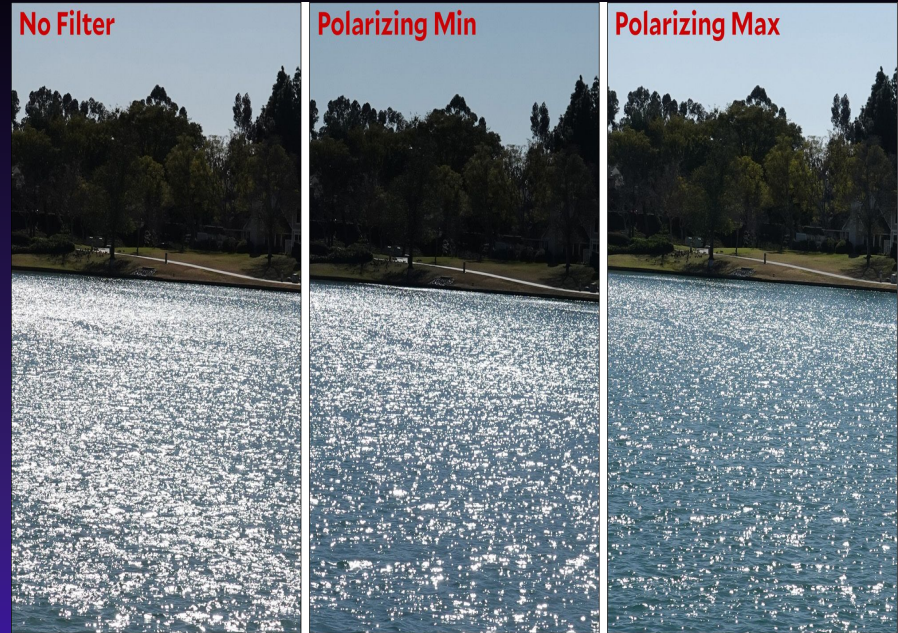
# Polarization

- Light can be polarized.
- **Polarization**- The measurement of the electromagnetic field's alignment ([nasa.gov](http://nasa.gov)).



# Applications

- **Cameras** use polarizer filters to reduce glare from water and to manage reflections.
- Polarized **3D glasses** restrict the amount of light that reaches each eye for a 3D effect.



Thank you for your attention :D

