Light

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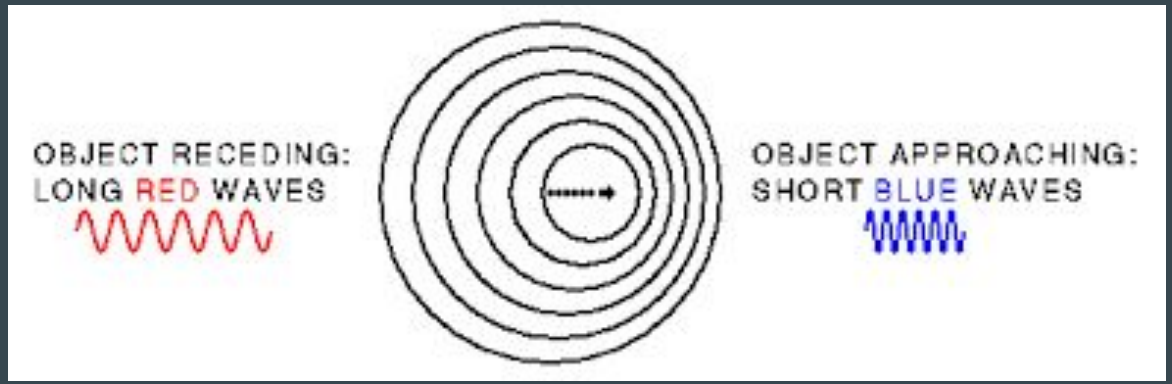
What is Light?

- Made of photons
- Energy emitted by vibrating electric charges
- Electromagnetic wave

Doppler Shift

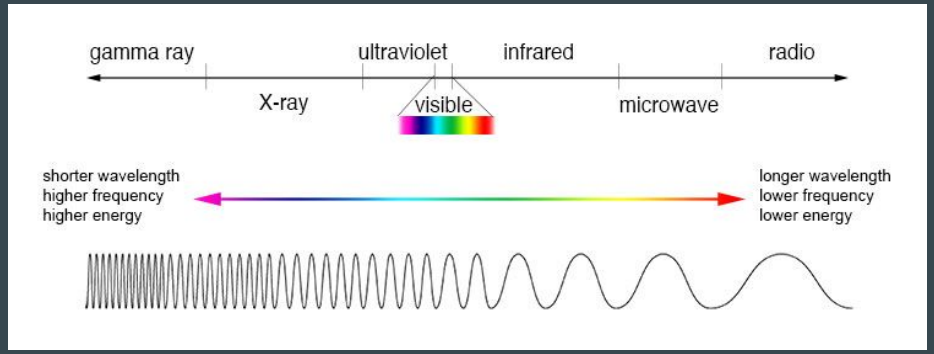
Light moves towards you→ higher frequency → blue (bluer) light

Light moves away from you → lower frequency → red (redder) light



Electromagnetic Spectrum

- Part that is visible to the human eye: Visible Spectrum (Very Small)
- Cannot see: Infrared (430 THz -) or Ultraviolet (770 THz +)
- All have different wavelengths and frequencies; same speed



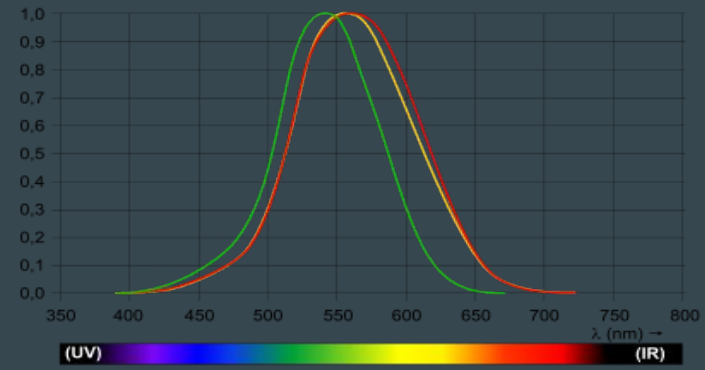
Intensity of Light

Brightness

- Brain's interpretation of light intensity
- Measured in the unit: Lux

Luminosity Function

- The colors in which we can see the best and the worst



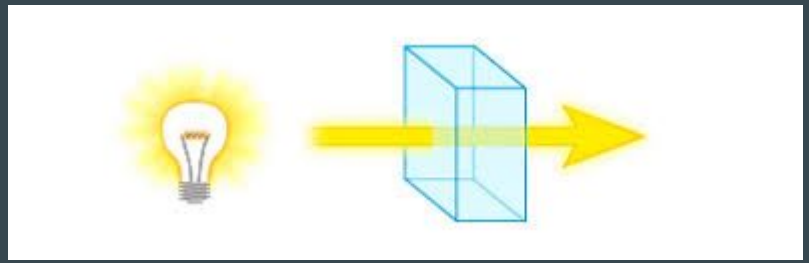
Light on Different Objects

- Light interacting with matter → matter responds in different ways
  - Depends on: frequency and natural frequency

- Opaque Material: If the frequency of light **matches** the natural frequency of electrons then object will resonate and the materials will heat up

- Transparent : If frequency of light **does not match** natural frequency of electrons then object is not able to sustain forced vibration

(electrons re-emit light)



Speed of Light

299,792,458 m/s

Reflection/Law of Reflection

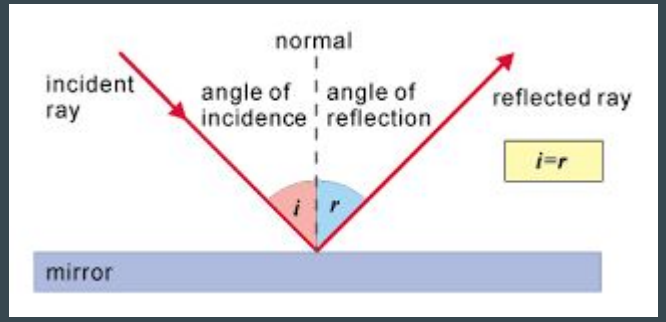
What is reflection?

- A wave reaches a boundary between two media, and some or all of the wave bounces back into the first medium

Reflection/Color

- If red is reflected, we see red
- If yellow is reflected, we see yellow
- If all colors are reflected, we see white
- If all colors are absorbed, we see black

Law of Reflection



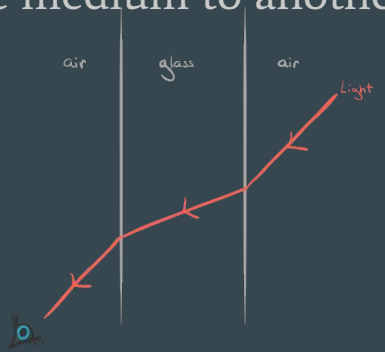
Angle of Incidence = Angle of Reflection

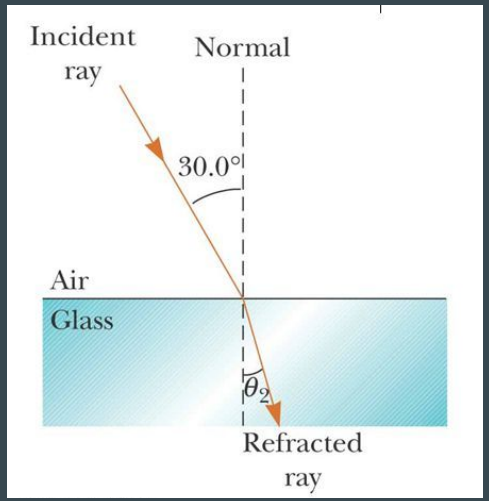
The angle that forms between the incidence ray and normal is equal to the angle that forms between the reflected ray and normal.

Specular Reflection	Diffuse Reflection
- SMOOTH surfaces - All light is reflected in the SAME direction	- ROUGH surfaces - Light is reflected in MANY directions

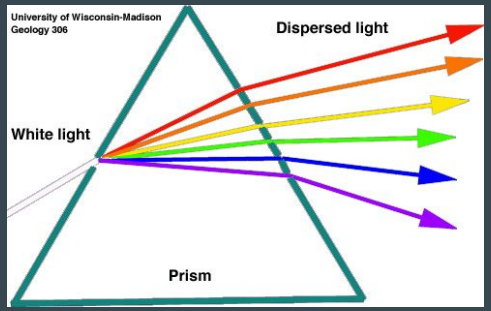
Refraction/Snell's Law

- Waves deflect when they pass from one medium to another
- Index of Refraction
  - n= $\frac{\text{Speed of light in vacuum}}{\text{Speed of light in material}}$





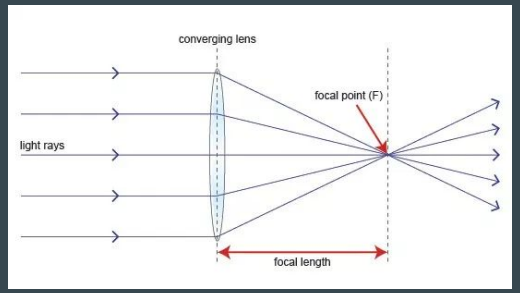
- Snell's law:
  - n1 sin θ1 = n2 sin θ2
    - Ex. 1.00029 □ sin(30) = 1.52 □ sin(θ_2)
- Dispersion:
  - Amount of light refracted in a medium depends on frequency
    - Light of frequencies close to natural frequency refract more



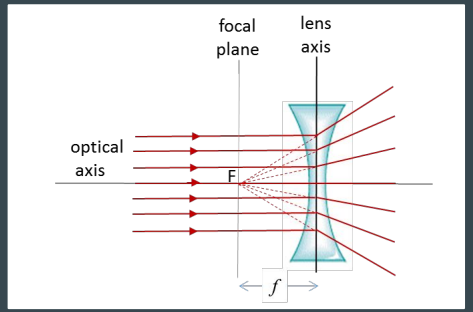
Lenses

- Lens: a piece of glass that bends parallel rays of light so they cross and form an image

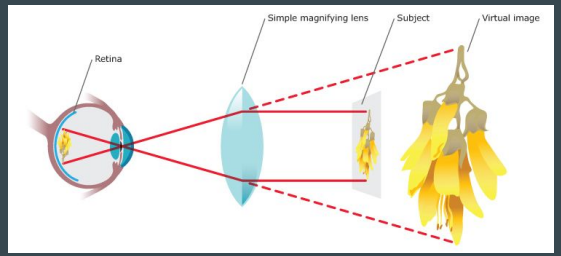
Converging lens



Diverging lens



- **Magnification** occurs when an image is viewed through a wider angle with the lens than without one



Particle vs Wave Debate

Is light a wave or a particle?

- Newton - Particle
- Huygens - Wave

Thomas Young used **diffraction**

(double-slit experiment)

CONCLUSION - NEITHER!