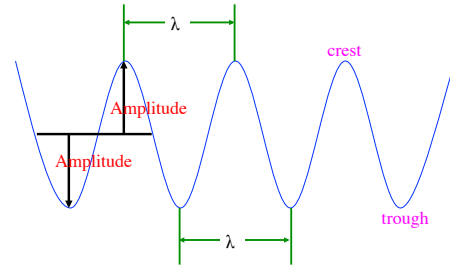


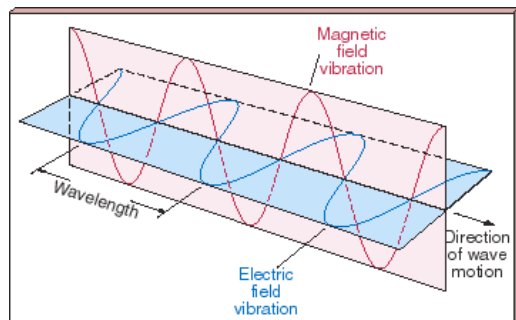
Light - electromagnetic radiation

- Electromagnetic radiation is a result of interactions of electricity and magnetism.
- Light travels as a transverse wave with crests and troughs in both magnetic and electric fields.
- [NASA Electromagnetic Spectrum](#)

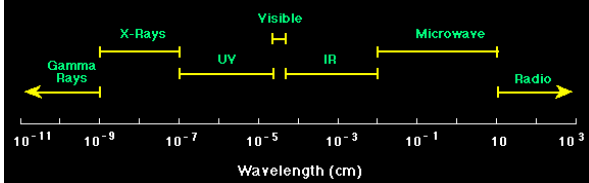
Transverse Waves



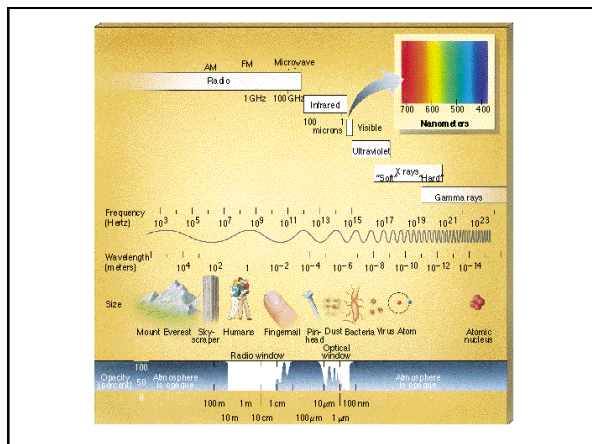
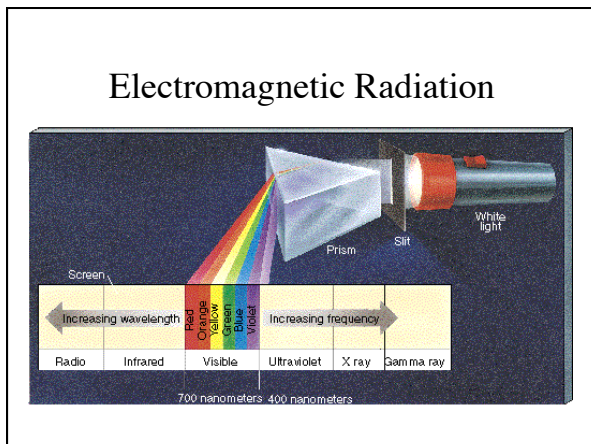
Electromagnetic Wave



Electromagnetic Spectrum



Electromagnetic Radiation



The Speed of Light

- The speed of light through space is constant, 3.00×10^8 m/s.
- The speed of a wave depends only on the kind of wave and the kind of material it travels through.
- The speed of light is the speed limit of the universe. The speed of light is the same in all reference frames.

Color, wavelength, frequency

- The frequency and wavelength of a wave are inversely proportional $c = f\lambda$.
- Changing the frequency or the wavelength do not change the speed of the wave.
- [Wavelength and Frequency](#)
- The amount of energy in the light depends on the frequency. Skin cancer discussion.

Colors

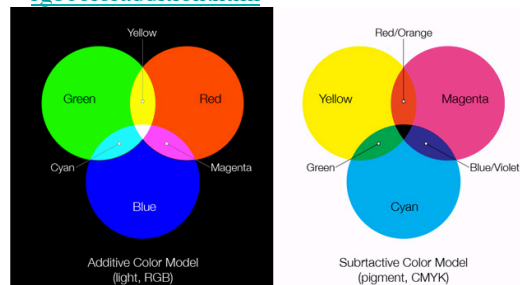
How do you see color?

<http://www.physicsclassroom.com/class/light/Lesson-2/Light-Absorption,-Reflection,-and-Transmission>

You see the light that is reflected!

Colors

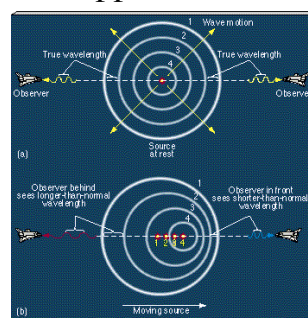
<http://www.mrmont.com/games/rgbcoloraddition.html>



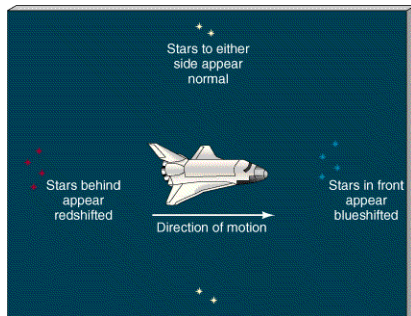
Doppler Effect

- The speed of a wave is determined **ONLY** by the kind of wave and the material it is traveling through.
- If the source of the wave is moving, the wave doesn't change speed, it changes the wavelength and frequency.
- The change in the frequency of a wave because of the motion of the source is called the Doppler Effect.

Doppler Effect



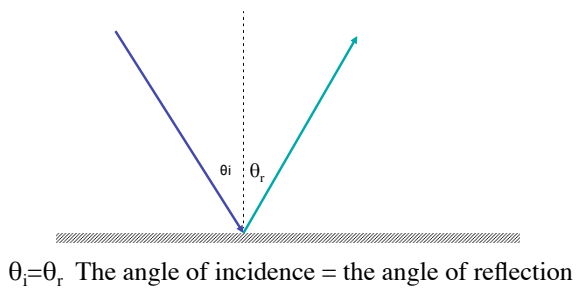
Doppler Effect



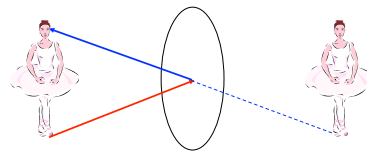
Law of Reflection

- Waves bounce off (reflect) following the law of reflection.
- The angle of incidence is equal to the angle of reflection.
- The angles are measured from the normal line.
- A normal line is defined as the line perpendicular (90 degrees) to the surface.

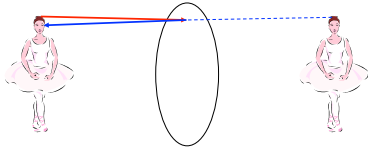
The law of reflection



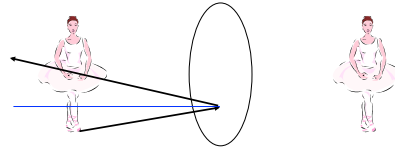
Plane Mirrors



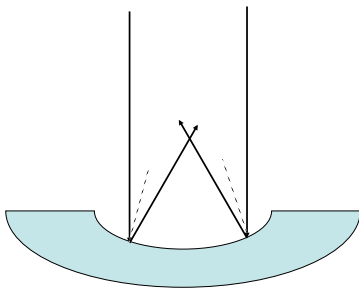
Plane Mirrors



Plane Mirrors



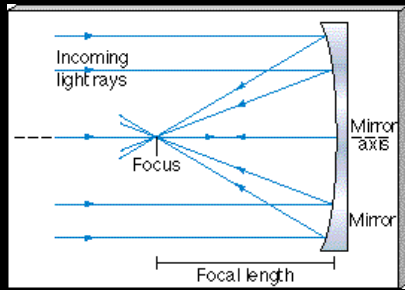
Curved Surfaces also follow the law of reflection



Mirrors

- Concave mirrors can gather and “focus” light.
- Convex mirrors actually spread out the light. The focus is virtual - light does not actually pass through the focus.

Reflector



Light Refraction

- Waves bend when going from one kind of material into another because the speed of the wave changes.
- This bending of light can also be used to gather and “focus” light.
- The relationship follows Snell’s Law.
- $n_1 \sin \theta_1 = n_2 \sin \theta_2$

Light Refraction

