Light

What is light?

Historically, people have had some funny views...

Pythagoras - Stream of particles from a source.
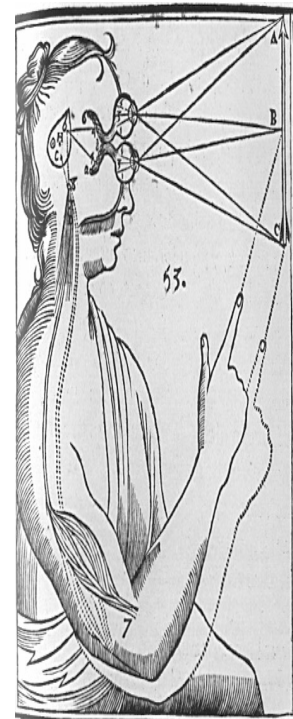
Aristotle - wave like ripples in a pond.

*Galileo attempted to measure speed of light.*

Danish Olaf Roemer did first good job at it by predicting eclipses of Jupiter's moons.
- determined light <u>not</u> instantaneous
*Huygens, a Dutch scientist used this data to calculate the speed of light.*

1907 Albert Michelson actually made accurate measurements (won Nobel Prize for it).

http://www.youtube.com/watch?v=eRNyOENeug0c
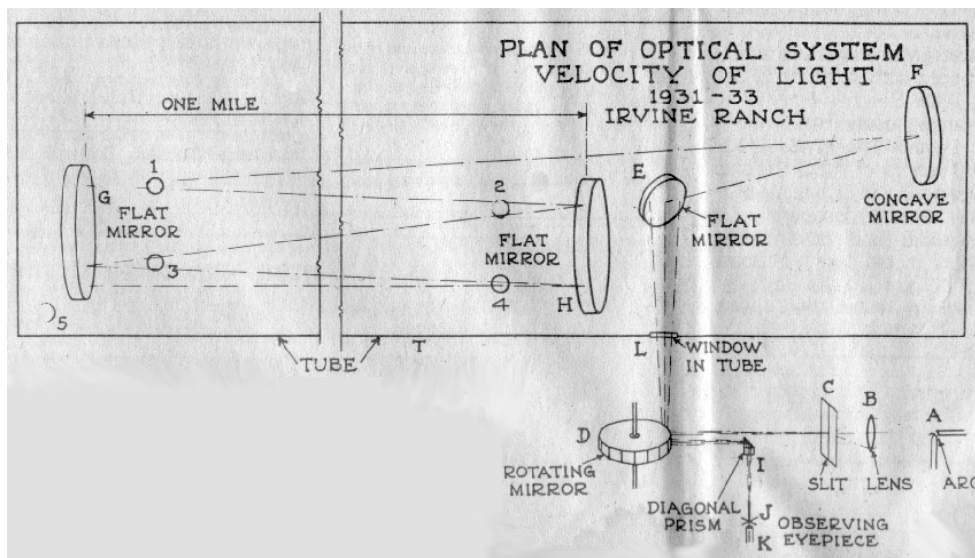
At the heart of the experiment, light was bounced off a rapidly rotating set of mirrors, back and forth down a mile-long tube and back to the mirrors, which by then would have moved slightly. If the speed of the mirror, the angle of the bounce and the length of the tube are known, it is possible to calculate the speed of light.

California Institute of Technology Archives
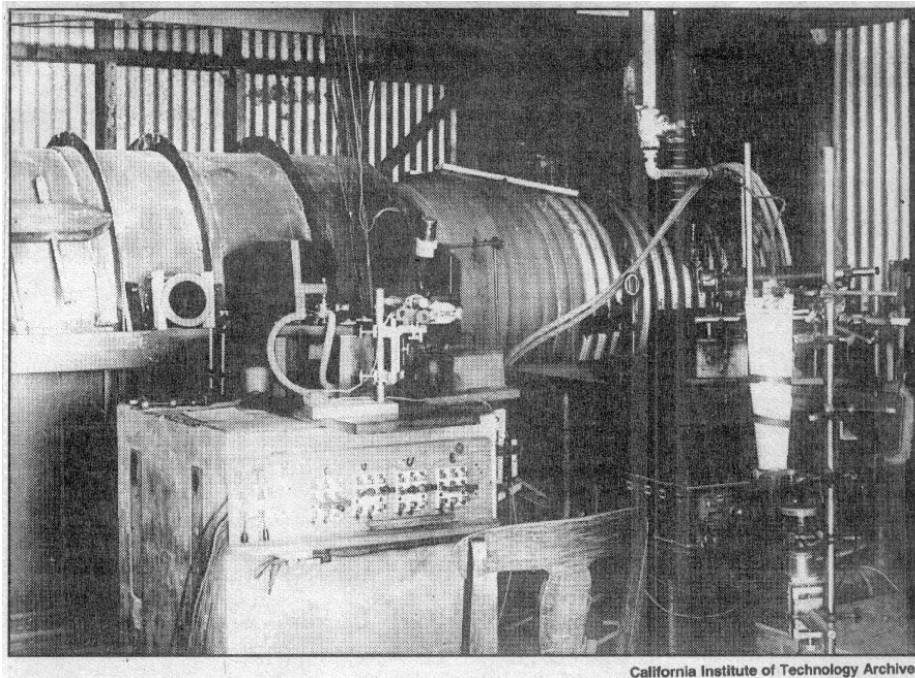
Characteristics of Light

1. Rectilinear Propogation
Light travels in a straight line.
The shadows we see are evidence of this.

2. Speed of Light
Today's accepted value for the speed of light, c is :

c = 3.00 x10^8 m/s in a vacuum.

Is light a wave or a particle? We will see it sometimes acts as a bit of both.

3. Light is a <u>Transverse</u> Wave

Light is an *<u>electromagnetic wave</u>*; made up of vibrating electric fields and magnetic fields. As the electric field vibrates it causes a magnetic field to vibrate which causes an electric field to vibrate and on and on and on...!
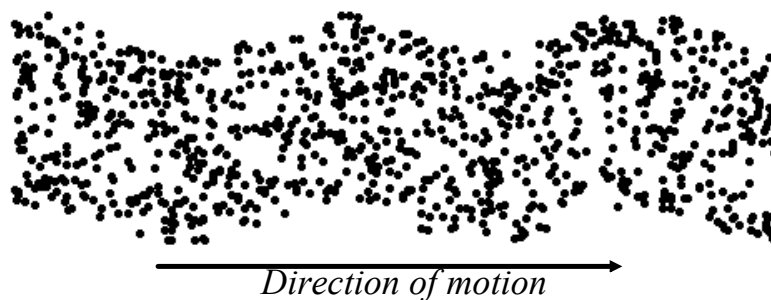
Since electric fields and magnetic fields can exist in a vacuum, light needs ı medium to travel.

Light is a transverse wave...

Transverse waves:
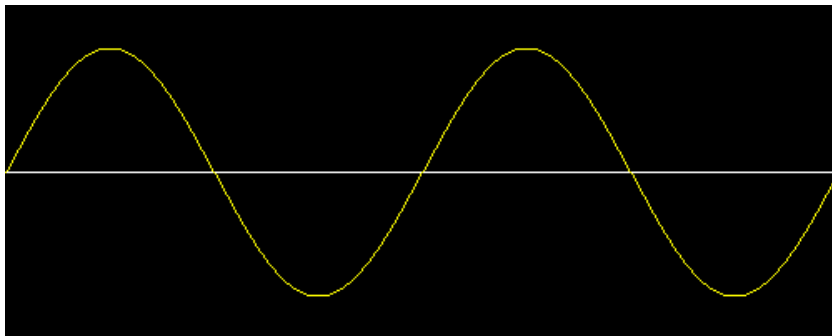Waves in which the particles are vibrating perpendicular (⊥) to the motion of the wave.

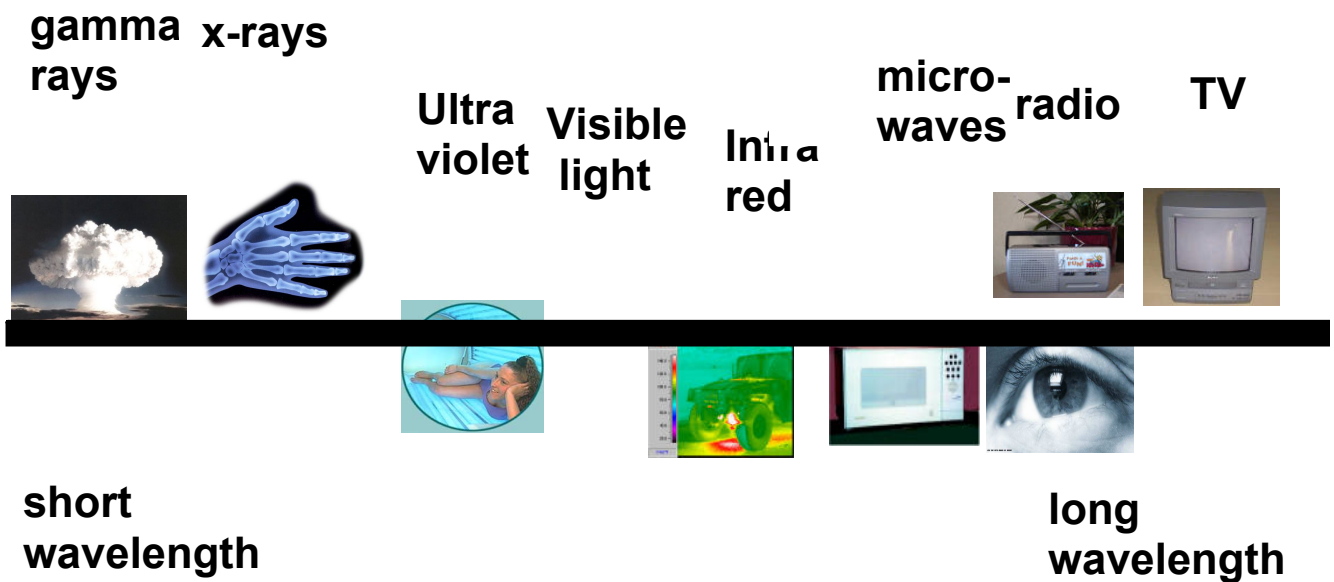*Draw and label. Include crests, troughs, wavelength, amplitude , in-phase and out of phase*

Direction of motion

more Transverse Waves...
http://www.acoustics.salford.ac.uk/feschools/waves/wavetypes.htm#trans

The Electromagnetic Spectrum
can you put them in order...???

gamma rays   **x-rays**

Ultra violet   **Visible light**   **Infra red**   **micro-waves**   **radio**   **TV**

short wavelength

long wavelength

The Electromagnetic Spectrum

gamma rays	x-rays	Ultra violet	Visible light	Infra red	micro- waves	TV	radio
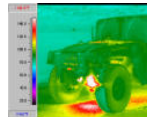
short
wavelength
high frequency
high energy

long
wavelength
short
frequency
low energy

Calculate frequency in Hertz and period in seconds for each of the situations below.

a) film slide operates at 64 frames per minute.

b) a patient's pulse rate is 72 Beats per minute

Calculate the period of vibration in seconds if the frequency is

a)   0.23 Hz   b)   5.2 MHz   c) 3.6×10^7 Hz

7.   Calculate the frequency in hertz of an object that vibrates with a period of

a)   0.003 s   b) 4.7×10^4 s   c)   6 hours

All these forms of energy obey the...

Universal Wave Equation

v = d/t

For 1 full wave ... v = λ/t

v = λ/T

v=fλ

1. 5.0 Hz waves travel along a rope with a wavelength of 40 cm. What is their speed?

2. The wavelength of a water wave is 3.7 m and its period is 1.5 s. Calculate:
a) speed of the wave

b) time required for the wave to travel 100 m.

c) distance travelled by the wave in 1.00 min

3. A television station broadcasts with a frequency of 90 MHz. If the speed of the electromagnetic wave is 3.00×10^8 m/s, what is the wavelength of the wave?

4. The frequency assigned to an FM station is 94.7 MHz. What is the wavelength of the waves if they travel at 3.0×10^8 m/s?