Waves

Wednesday, May 05, 2010 9:31 PM

Waves are the method of transmitting energy from place to place. The material through which a wave moves is called a MEDIUM (plural media). Only electro-magnetic waves (EM waves) and gravitational waves require no media to move through. EM waves can move through a vacuum. Waves oscillate (back and forth motion), a pulse is not a wave, but is instead a single disturbance.

$f = \frac{\text{cycles}}{\text{sec}}$

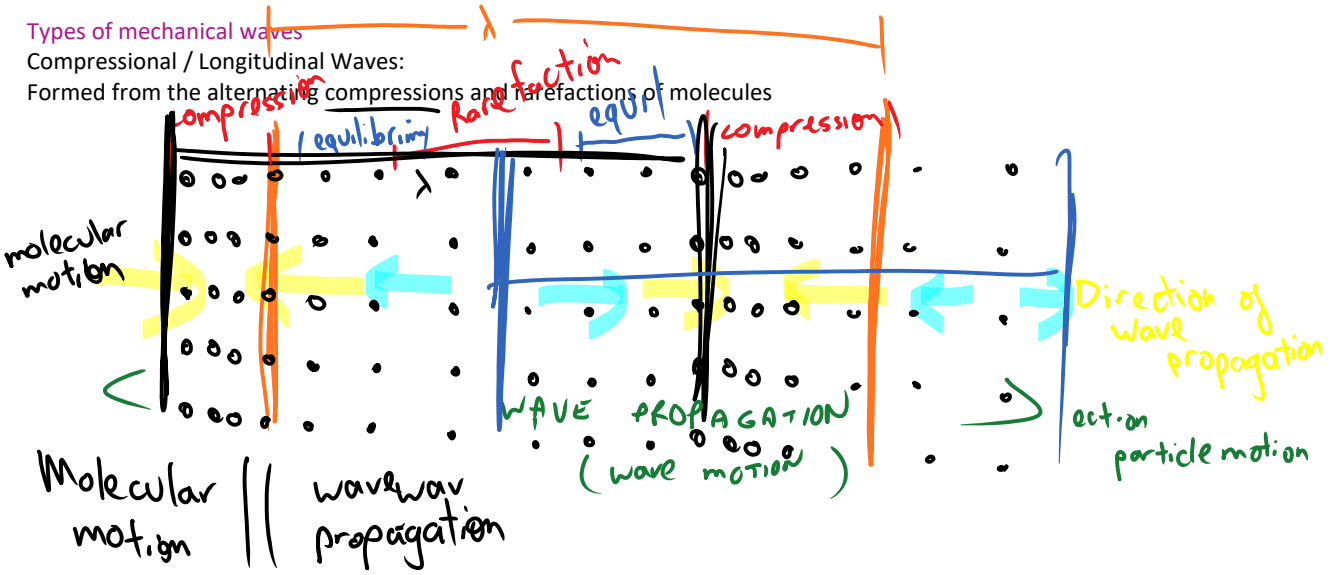
Frequency <= number of cycles of a repeated event which occur per second. Units of frequency are HERTZ (Hz) often called s^{-1}.
Frequency is f in equations

λ base

Wavelength is the distance through space occupied by two points on a wave which are in the same part of their cycle. Measured in meters, symbol in equations is λ.

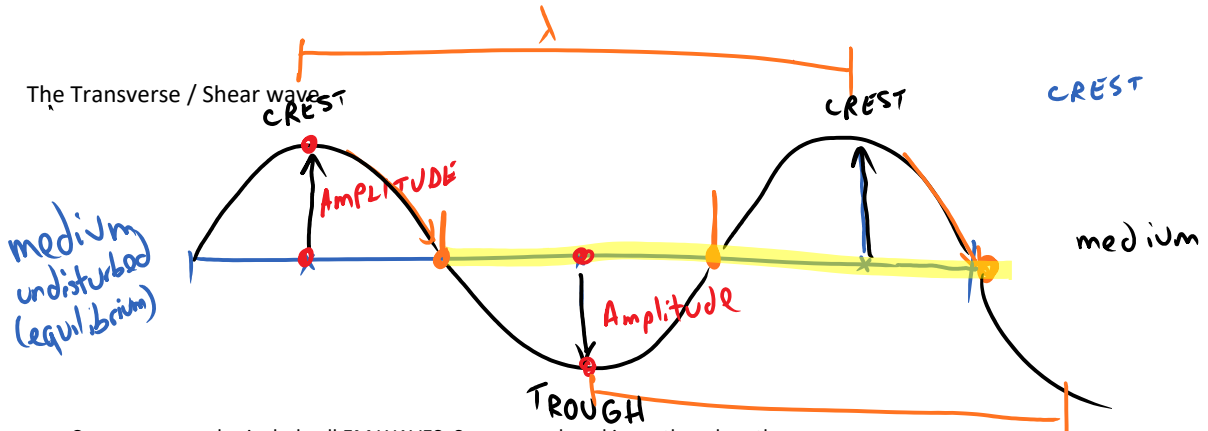
Amplitude the displacement of a wave from it equilibrium position to crest or trough for a transverse wave.

Types of mechanical waves
Compressional / Longitudinal Waves:
Formed from the alternating compressions and rarefactions of molecules



Examples include sound waves, and P-waves in earthquakes.
The displacement of the molecules is parallel to the wave propagation

The Transverse / Shear wave



Common examples include all EM WAVES, S-wave produced in earthquakes, the wave
(Done in stadia)

Particle motion ⊥ to wave propagation

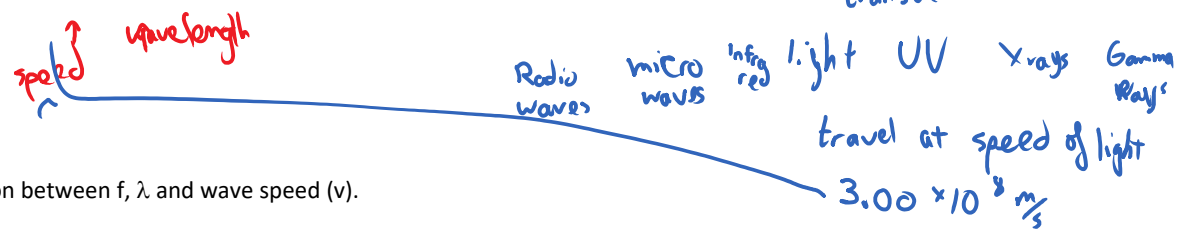
The direction of wave propagation is perpendicular to particle motion

Standing waves can be created IF the wave frequency is a whole number multiple of the Object's length. A standing wave is a wave which reflects from end to end of the object creating point of maximum amplitude and points of zero amplitude. These are found by adding the reflected waves to the incoming waves.

All objects have specific frequencies at which they RESONATE. Standing waves reflect forth and back adding their amplitudes to attain very large amplitude.

Wave Equation $v = \lambda f$ (frequency)

EM waves: no medium required, transverse wave



There is a relation between f, λ and wave speed (v).

EM waves all travel through a vacuum at the same speed, speed of light, c = 3.00 x 10 ^{8} m/s. Determine the frequency of a yellow light ray whose wavelength is 600 nm.

Visible light

700 nm — 400 nm

violet

$V = \lambda f$

$3 \times 10^{8} = 600 \times 10^{-9} f$

$f = 5.0 \times 10^{14}$ Hz Red

600×10^{-9}

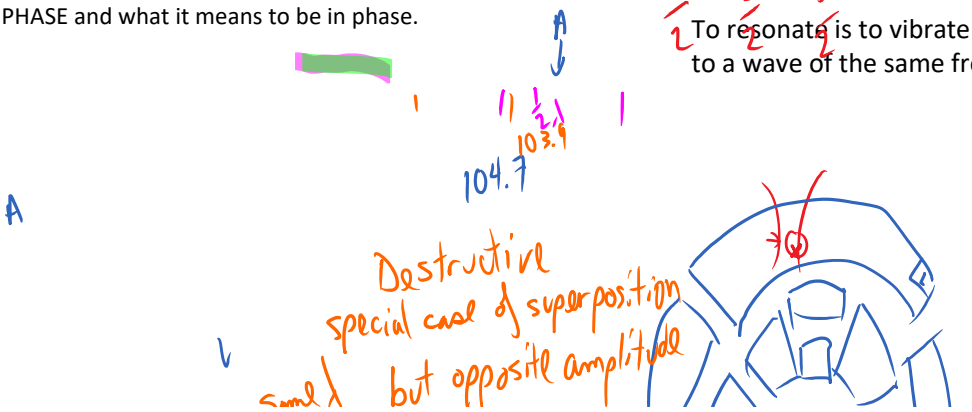
1. p.670 draw the EM spectrum label which end has high and low energy
2. What is the Principle of Superposition?
3. Sketch 2 pulses approaching each other which will exhibit constructive Interference and 2 which will exhibit destructive interference.
4. What is refraction?
5. What type of waves can be polarized?
6. Define PHASE and what it means to be in phase.

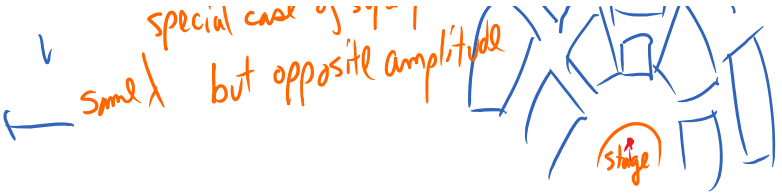
Resonance: a property of matter based on shape, molecular density and temperature that allow waves to last a long time in a substance. A wave will RESONATE back and forth in an object if the wave frequency is a whole number multiple of the frequency of the object.

1 3 5

2 2 2

To resonate is to vibrate at a specific frequency when exposed to a wave of the same frequency.





A

B

D 1.3