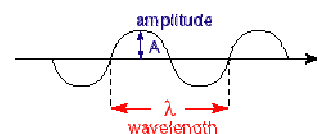




WAVES GLOSSARY

**amplitude**

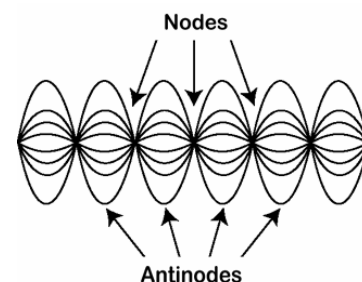
The maximum distance from the equilibrium position that occurs in periodic motion. The greater the amplitude, the greater the energy of the wave.

angstrom

A unit of distance corresponding to 10^{-10} m. One angstrom (\AA) is 0.1 nm so a wavelength of 4500 \AA corresponds to 450 nm.

antinode

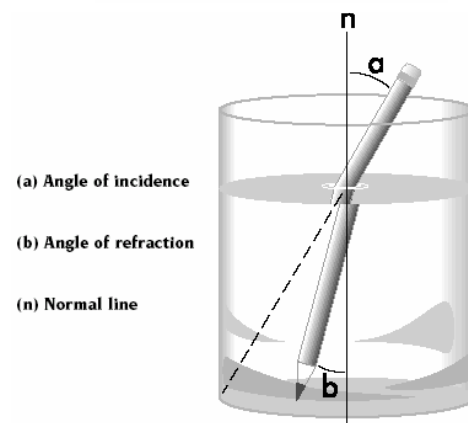
One of the positions in a standing wave or interference pattern where there is maximal movement; that is, the amplitude is a maximum.

**angle of reflection**

The angle between a ray which is reflected from a surface, and the normal to that surface.

angle of refraction

The angle between the ray which is refracted at a surface and the normal to that surface.

**beats**

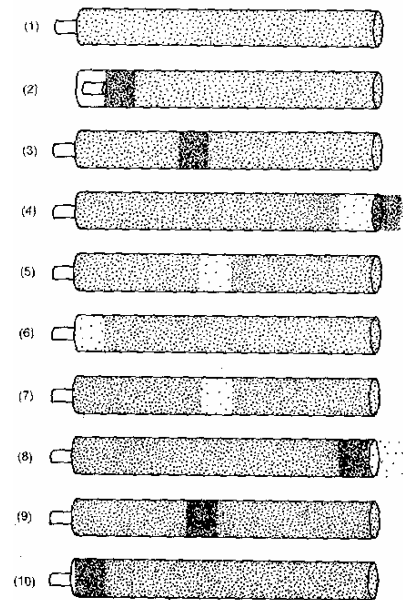
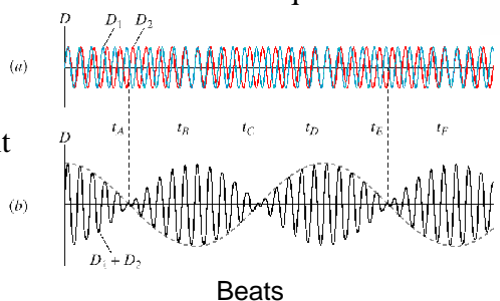
A variation in the amplitude resulting from the superposition (interference) of two waves that have nearly the same frequencies. The beat frequency is equal to the difference in the two frequencies.

$$f_{\text{beat}} = |f_2 - f_1|$$

closed tube

A pipe open at one end. The resonant lengths of the air column in a closed tube are given by

$$L = \frac{n\lambda}{4} \quad n = 1, 3, 5, \dots$$



Closed Tube Resonance

crest

The peak of a wave disturbance.

critical angle

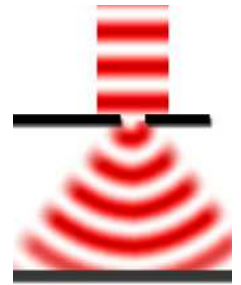
The minimum angle of incidence for which total internal reflection occurs.

cycle

One complete repetition of a periodic motion. It may start anywhere in the motion.

diffraction

The spreading of waves passing through an opening or around a barrier.



Diffraction

diffraction grating

A device used to break up light into its component wavelengths. It usually consists of a material with tiny groves or opaque lines that diffract the light.

dispersion

The spreading of light into a spectrum of colour. All transparent materials disperse white light because refractive index varies with wavelength. Longer wavelengths like red light are refracted less than shorter wavelengths such as blue light.

Doppler effect

A change in the frequency of a periodic wave due to the motion of the observer, the source, or both.

$$f' = f \left(\frac{v \pm v_o}{v \mp v_s} \right)$$

electromagnetic wave

A transverse wave consisting of oscillating electric and magnetic fields. They are caused by moving electric charges. Light is an electromagnetic wave. In a vacuum, the speed of an electromagnetic wave, $c = 3.0 \times 10^8$ m/s.

electromagnetic spectrum

The complete range of electromagnetic waves from lowest to highest energy and frequency or from largest to smallest wavelengths, the bands of the electromagnetic spectrum are radio waves, microwaves, infrared, visible light (*ROYGBIV*), ultraviolet, x-rays and gamma rays.

emission spectrum

The collection of discrete wavelengths emitted by atoms that have been excited by heating or by electric currents.

frequency

The number of times a periodic motion repeats in a unit of time. It is equal to the inverse of the period. Measured in hertz. Frequency is the he inverse of the period T.

fundamental frequency

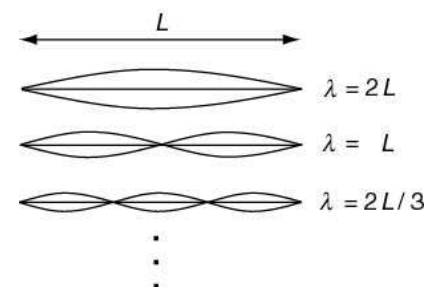
The lowest resonant frequency for an oscillating system.

gamma (γ) radiation

The range of frequencies of the electromagnetic spectrum that lies beyond the X rays. The type of radioactive decay in which nuclei emit high-energy photons. The daughter nucleus is the same as the parent.

harmonic

A frequency that is a whole-number multiple of the fundamental frequency.



First Three String Harmonics
(decreasing wavelength – increasing frequency)²

Huygens' Principle

Each point on a propagating wave can be considered as the source of a small wave, or wavelet which propagates at the same speed as the original wave. The new wave front for the propagating wave can be constructed by drawing a line tangent to the edges of these wavelets.

incident

Falling or shining upon. When light is incident on something it is reflected, refracted, absorbed or any combination of these.

in phase

Two or more waves with the same wavelength and frequency that have their crests lined up.

index of refraction

An optical property of a substance that determines how much light bends upon entering or leaving it. The index of refraction is the ratio of the speed an electromagnetic wave in vacuum to the speed of the electromagnetic wave in a particular medium, typically denoted by the lowercase n . $n = \frac{c}{v}$. The index of refraction is a property of the medium and the incident electromagnetic wave. The index of refraction of a vacuum is exactly 1.0. Water has an index of refraction of 1.33.

infrared

A region or band of the electromagnetic spectrum of lower energy and longer wavelength than visible light. Infrared wavelengths range from roughly 1.0 mm to 780 nm.

infrasonic

Sound waves with frequencies below the range humans can hear (roughly below 20 Hz).

interface

The boundary between two different materials or media.

interference

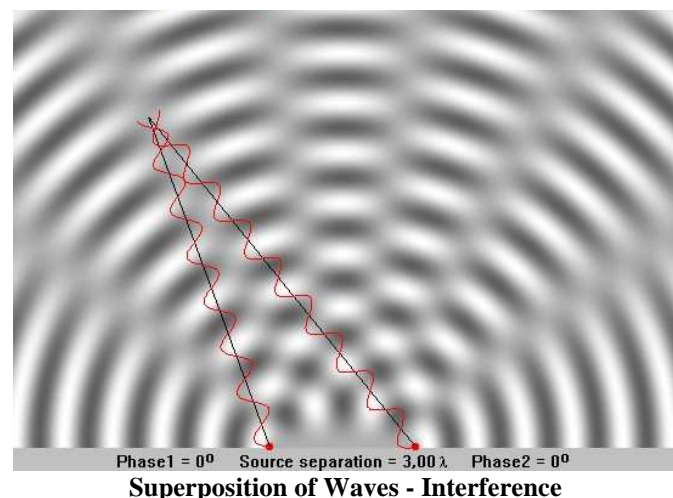
The superposition of waves. The result of waves impinging on one another. **Constructive interference** occurs when waves are nearly in phase or when crests meet crests and troughs meet troughs. **Destructive interference** occurs when the waves are nearly 180° out of phase or when crests cancel out the troughs of the waves.

laser

An acronym for light amplification by stimulated emission of radiation. A device that uses stimulated emissions to produce a coherent beam of electromagnetic radiation.

light ray

A line that represents the path of light in a given direction.



longitudinal wave

A wave in which the vibrations of the medium are parallel to the direction the wave is moving.

monochromatic

Light of a single wavelength.

normal

A line perpendicular to a surface (like a mirror surface) or interface between two media (refraction problems).

oscillation

A vibration about an equilibrium position.

open tube

A pipe open at both ends. The resonant lengths of the air column in an open tube are given by

$$L = \frac{n\lambda}{2} \quad n = 1, 2, 3, \dots$$

period

The time to complete a cycle.

periodic wave

A wave in which all the pulses have the same size and shape. The wave pattern repeats itself over a distance of 1 wavelength and over a time of 1 period.

prism

A device that can separate light into component wavelengths. It is usually a triangular piece of glass through which light can pass and be dispersed. White light is dispersed into a spectrum or “rainbow” of colours.

Mach number

The ratio of the speed of an object to the speed of sound.

ray

A geometric representation of a light wave by a line normal to the electromagnetic wave front; (*i.e.*, in the direction of propagation of the wave).

reflection, law of

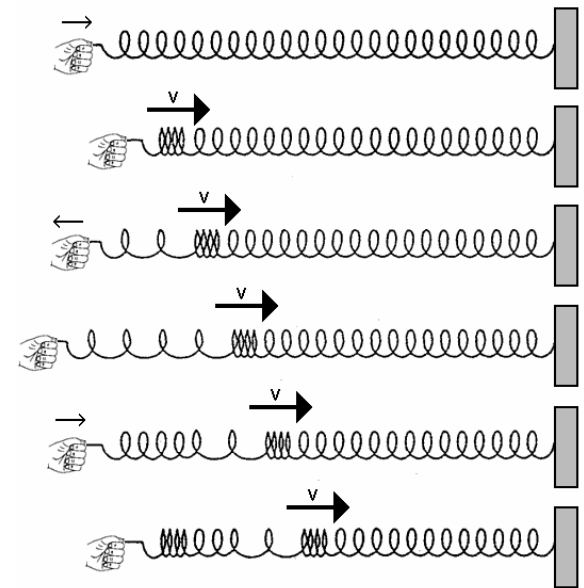
The angle of reflection (measured relative to the normal to the surface) is equal to the angle of incidence. The incident ray, the reflected ray, and the normal all lie in the same plane.

refraction

The bending of light that occurs at the interface between two transparent media such as air and water. It occurs when the speed of light changes. Sound waves, unlike light waves, travel faster in denser materials, such as solids and liquids, than they travel in air. When sound waves enter a solid, their velocity and wavelength *increase* and they are bent away from the normal to the surface of the solid.

resonance

A large increase in the amplitude of a vibration when a force is applied at a natural frequency of the medium or object.



Propagating Longitudinal Wave

spectroscope

A device used to separate light or electromagnetic waves by dispersion or diffraction so that the component wavelengths can be measured.

Snell's Law

Snell's Law relates the indices of refraction n of the two media to the directions of propagation in terms of the angles to the normal. Specifically: $n_1 \sin \theta_1 = n_2 \sin \theta_2$

sound

A longitudinal wave that consists of a sequence of pressure pulses or elastic displacements of the material, whether gas, liquid, or solid, in which the wave propagates. In gases, sound waves consists of a sequence of compressions (dense gas) and rarefactions (less dense gas) that travel through the gas.

spectrum

The result of breaking up polychromatic light such as white light into its various wavelengths to produce a “rainbow” of colours.

speed

The speed a single pulse is simply distance/time or for a periodic wave speed is given by wavelength/period; $v = \frac{\lambda}{T} = f\lambda$) Only an alteration in the properties of the medium will cause a change in the speed. For a given source of waves, if the speed is increased (by a changing medium), then the wavelength also increases – the frequency is governed only by the source of the disturbance.

standing wave

The interference pattern produced by two periodic waves of equal amplitude and frequency traveling in opposite directions. The pattern is characterized by alternating nodal and antinodal regions.

superposition

The combining of two or more waves at a location in space.

total internal reflection

When light is traveling from a material with a higher index of refraction into one with a lower index of refraction, if the angle of incidence exceeds the critical angle, the light is totally reflected.

transverse wave

A wave in which the vibrations of the medium are perpendicular to the direction the wave is moving.

trough

A valley of a wave disturbance.

ultrasonic

Sound waves with frequencies above the range humans can hear (roughly above 20 000 Hz).

ultraviolet

A region or band of the electromagnetic spectrum beyond violet. UV wavelengths range from roughly 375 nm to 12.5 nm.

wave

The movement of energy from one place to another without any net movement of matter. A wave is a disturbance which moves along a medium from one end to the other.

wavelength

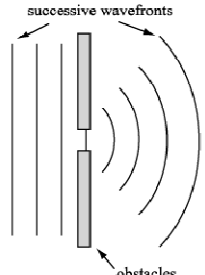
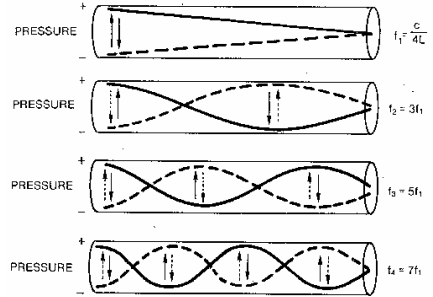
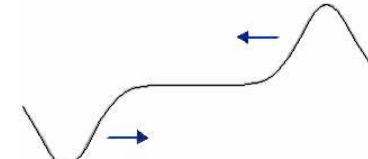
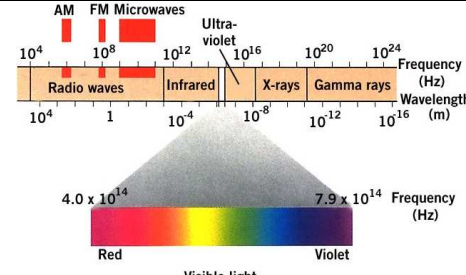
The shortest repetition length for a periodic wave. For example, it is the distance from crest to crest or from trough to trough. Wavelength is typically denoted by the Greek letter lambda (λ).

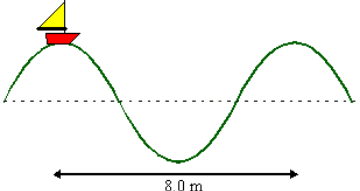
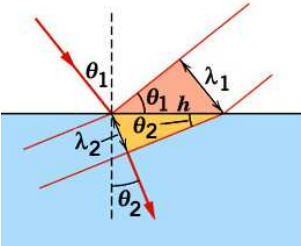
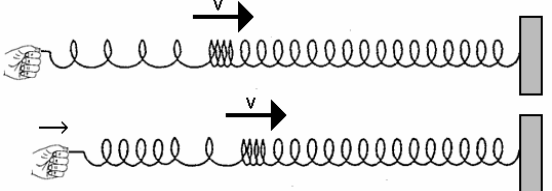
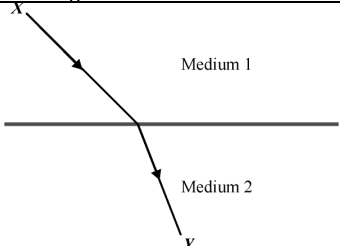
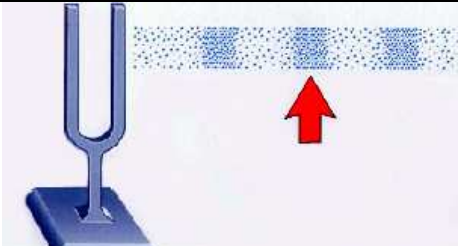
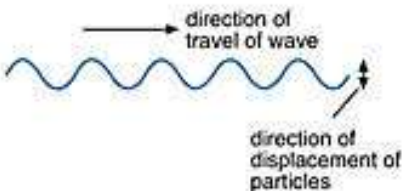
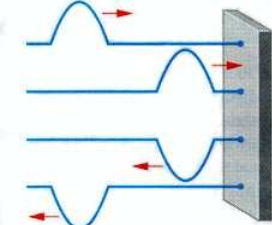
x ray

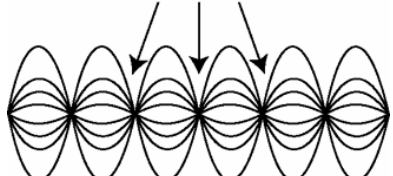
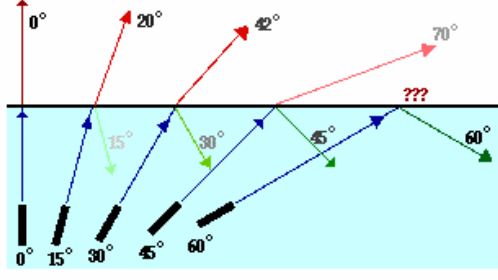
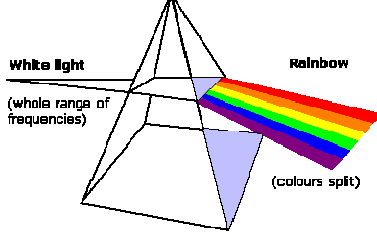


A high-energy photon, usually produced by cathode rays or emitted by electrons falling to lower energy states in atoms. The range of frequencies in the electronic spectrum lying between the ultraviolet and the gamma rays.

Try Matching Questions:

Match the word(s) on the left with the associated picture on the right. Write the letter in the blank space beside the picture.

	wave terms	wave pictures
a)	transverse wave	
b)	Law of Refraction	
c)	refraction	
d)	total internal reflection	

e)	Doppler Effect	_____	
f)	nodes	_____	
g)	supersonic	_____	
h)	destructive interference	_____	
i)	dispersion	_____	
j)	electromagnetic spectrum	_____	
k)	frequencies	_____	

l)	compression	
m)	wavelength	
n)	reflection	
o)	resonance	
p)	diffraction	
q)	longitudinal wave	