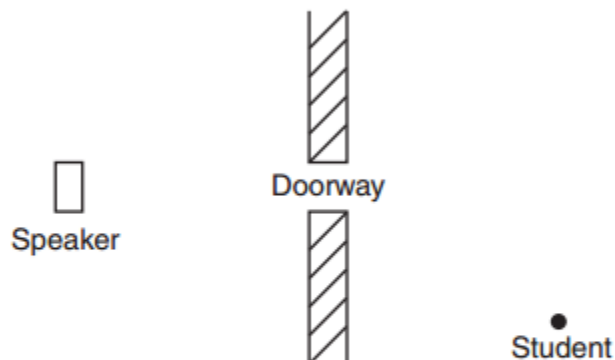


MC1

A student listens to music from a speaker in an adjoining room, as represented in the diagram below.



She notices that she does not have to be directly in front of the doorway to hear the music. This spreading of sound waves beyond the doorway is an example of

- (1) the Doppler effect
- (2) resonance
- (3) refraction
- (4) diffraction

MC2 (Refer to Page 5 for Index of Refractions)

A ray of yellow light ($f = 5.09 \times 10^{14}$ Hz) travels at a speed of 2.04×10^8 meters per second in

- (1) ethyl alcohol
- (2) water
- (3) Lucite
- (4) glycerol

MC3

Transverse waves are to radio waves as longitudinal waves are to

- (1) light waves
- (2) microwaves
- (3) ultraviolet waves
- (4) sound waves

MC4

As a monochromatic light ray passes from air into water, two characteristics of the ray that will *not* change are

- (1) wavelength and period
- (2) frequency and period
- (3) wavelength and speed
- (4) frequency and speed

MC5

A beam of light has a wavelength of 4.5×10^{-7} meter in a vacuum. The frequency of this light is

- (1) 1.5×10^{-15} Hz
- (2) 4.5×10^{-7} Hz
- (3) 1.4×10^2 Hz
- (4) 6.7×10^{14} Hz

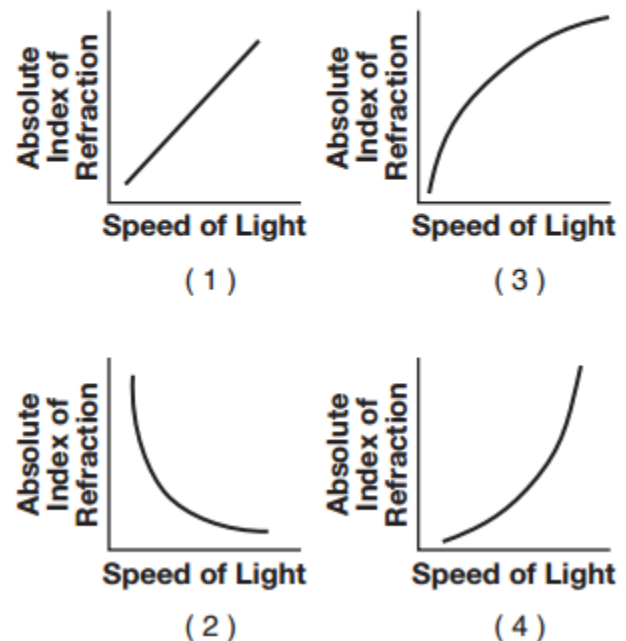
MC6

When x-ray radiation and infrared radiation are traveling in a vacuum, they have the same

- (1) speed
- (2) frequency
- (3) wavelength
- (4) energy per photon

MC7

Which graph best represents the relationship between the absolute index of refraction and the speed of light ($f = 5.09 \times 10^{14}$ Hz) in various media?



MC8 (Refer to Page 5 for Index of Refractions)

What is the speed of light ($f = 5.09 \times 10^{14}$ Hz) in ethyl alcohol?

- (1) 4.53×10^{-9} m/s
- (2) 2.43×10^2 m/s
- (3) 1.24×10^8 m/s
- (4) 2.21×10^8 m/s

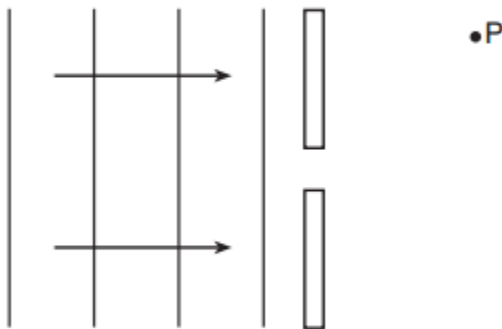
MC9 (Refer to page 5 for the Electromagnetic Spectrum)

An electromagnetic wave is produced by charged particles vibrating at a rate of 3.9×10^8 vibrations per second. The electromagnetic wave is classified as

- (1) a radio wave
- (2) an infrared wave
- (3) an x ray
- (4) visible light

MC10

The diagram below shows a series of wave fronts approaching an opening in a barrier. Point *P* is located on the opposite side of the barrier.



The wave fronts reach point *P* as a result of

- (1) resonance
- (2) refraction
- (3) reflection
- (4) diffraction

MC11

A student claps his hands once to produce a sudden loud sound that travels through the air. This sound is classified as a

- (1) longitudinal mechanical wave
- (2) longitudinal electromagnetic wave
- (3) transverse mechanical wave
- (4) transverse electromagnetic wave

MC12

A student generates water waves in a pool of water. In order to increase the energy carried by the waves, the student should generate waves with a

- (1) greater amplitude
- (2) higher frequency
- (3) greater wavelength
- (4) longer period

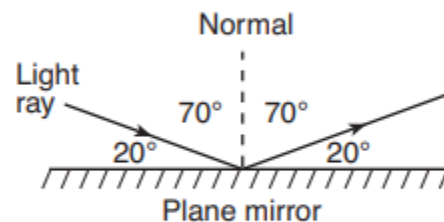
MC13

A wave generator produces straight, parallel wave fronts in a shallow tank of uniform-depth water. As the frequency of vibration of the generator increases, which characteristic of the wave will always decrease?

- (1) amplitude
- (2) phase
- (3) wavelength
- (4) speed

MC14

The diagram below represents a light ray reflecting from a plane mirror.



The angle of reflection for this light ray is

- (1) 20°
- (2) 70°
- (3) 140°
- (4) 160°

MC15

A microwave with a frequency of 5.0×10^{10} hertz has a period of

- (1) 2.0×10^{-11} s
- (2) 6.0×10^{-3} s
- (3) 1.7×10^2 s
- (4) 1.5×10^{19} s

MC16

Which waves require a material medium for transmission?

- (1) light waves
- (2) radio waves
- (3) sound waves
- (4) microwaves

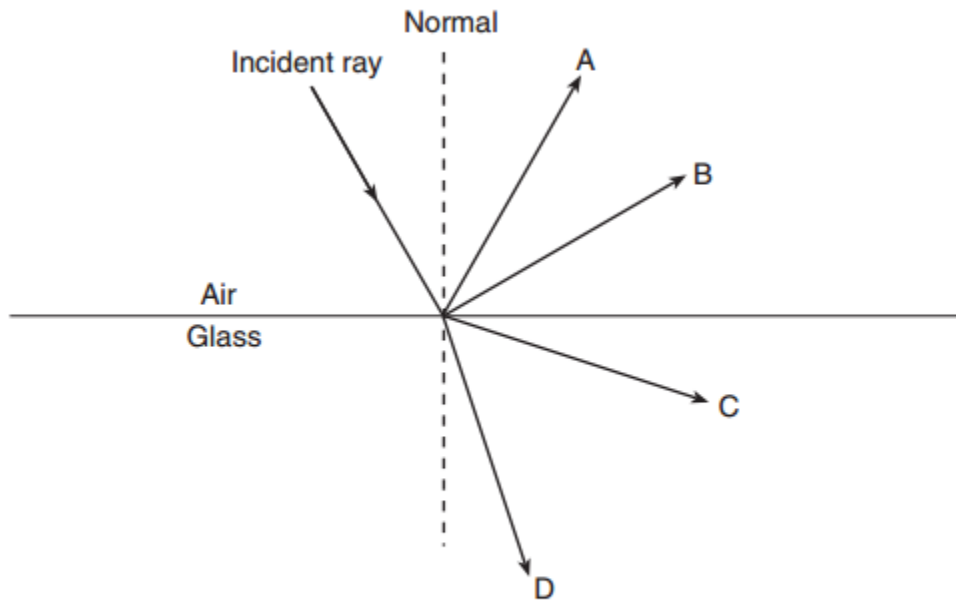
MC17

Which type of oscillation would most likely produce an electromagnetic wave?

- (1) a vibrating tuning fork
- (2) a washing machine agitator at work
- (3) a swinging pendulum
- (4) an electron traveling back and forth in a wire

MC18

The diagram below shows a ray of monochromatic light incident on a boundary between air and glass.

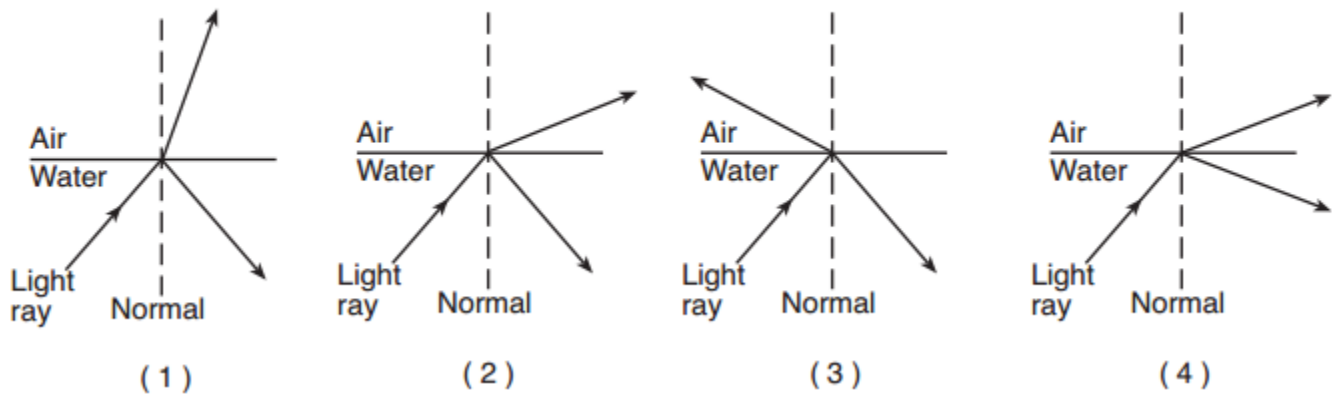


Which ray best represents the path of the reflected light ray?

- | | |
|-------|-------|
| (1) A | (3) C |
| (2) B | (4) D |

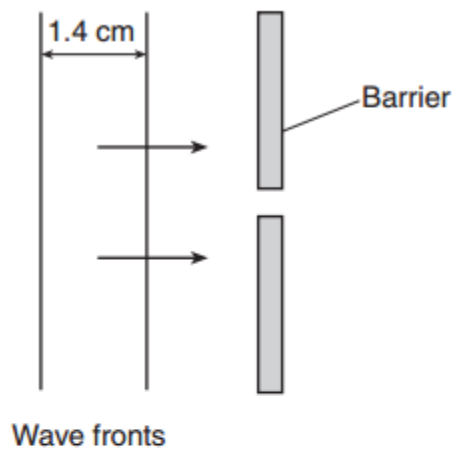
MC19

When a ray of light traveling in water reaches a boundary with air, part of the light ray is reflected and part is refracted. Which ray diagram best represents the paths of the reflected and refracted light rays?

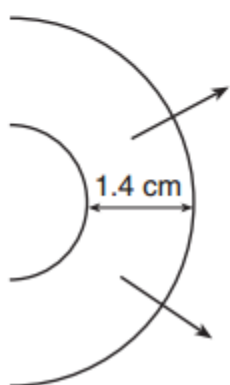


MC20

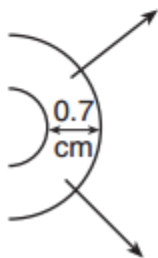
The diagram below shows a series of straight wave fronts produced in a shallow tank of water approaching a small opening in a barrier.



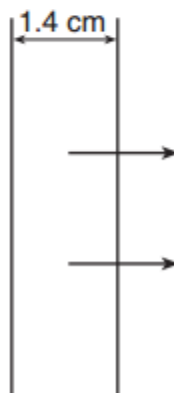
Which diagram represents the appearance of the wave fronts after passing through the opening in the barrier?



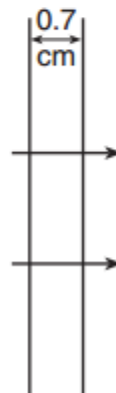
(1)



(2)

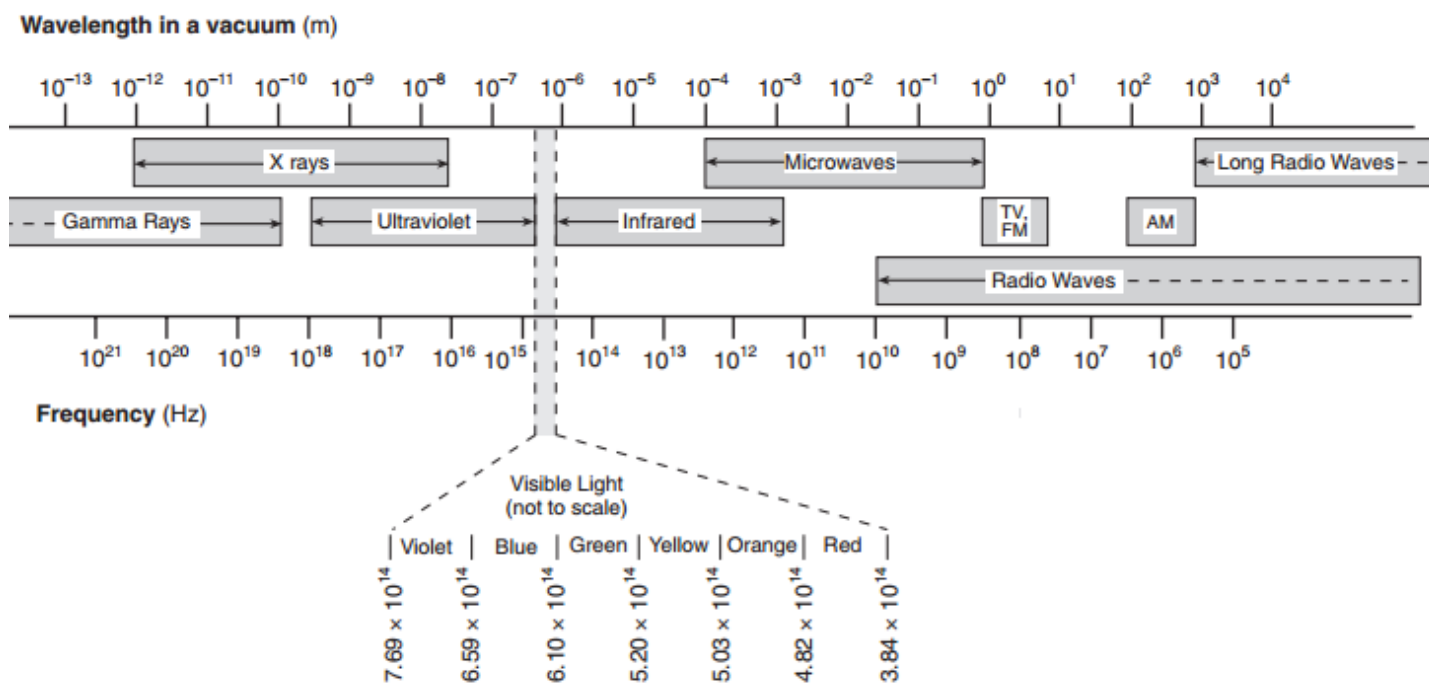


(3)



(4)

The Electromagnetic Spectrum



Absolute Indices of Refraction

($f = 5.09 \times 10^{14}$ Hz)

Air	1.00
Corn oil	1.47
Diamond	2.42
Ethyl alcohol	1.36
Glass, crown	1.52
Glass, flint	1.66
Glycerol	1.47
Lucite	1.50
Quartz, fused	1.46
Sodium chloride	1.54
Water	1.33
Zircon	1.92